Atlantic Richfield Company

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December 7, 2018

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P.O. Box 200901
Helena, Montana 59620-0901

RE: Butte Priority Soils Operable Unit (BPSOU), Silver Bow Creek/Butte Area NPL Site
Revision to Final Butte Priority Soils Operable Unit (BPSOU) Surface Water Monitoring Quality Assurance Project Plan (QAPP) 2018 Monitoring Period, June 2018

Gentlemen:

I am writing to you on behalf of Atlantic Richfield Company to submit revised tables and figures for the approved Silver Bow Creek/Butte Area NPL Site Final Butte Priority Soils Operable Unit Surface Water Monitoring Quality Assurance Project Plan (QAPP) 2018 Monitoring Period, dated June 21, 2018. The tables and figures have been updated to reflect actual monitoring performed in 2018. The attached table summarizes differences between the monitoring network provided in the June 21, 2018 QAPP and the actual monitoring that was performed in 2018. A table has been added to the QAPP; thus, changing the number of all subsequent tables and requiring numerous edits throughout the QAPP to reflect the revised table numbers. Therefore, the hard copy submittal includes the entirety of the QAPP. EPA and DEQ are receiving hard copy submittals; all others will receive via email.

If you have questions or concerns, please do not hesitate to call me at (406) 723-1834.

Sincerely,

Josh Bryson, PE, PMP
Operations Project Manager
Remediation Management Services Company
An affiliate of **Atlantic Richfield Company**

Cc: Patricia Gallery / Atlantic Richfield - email
Lindy Hanson/ Atlantic Richfield - email
Cord Harris / Atlantic Richfield – email
Loren Burmeister / Atlantic Richfield - email
Chuck Stilwell / Atlantic Richfield - email
Jean Martin / Atlantic Richfield - email
Terry Moore / Atlantic Richfield - email
Irene Montero / Atlantic Richfield - email
Ray Vose / Atlantic Richfield - email
Bill Duffy / DGS – email
Mave Gasaway / DGS – email
John Davis / PRR - email
Nikia Greene / EPA - email
Henry Elsen / EPA - email
Joe Vranka / EPA - email
David Shanight / CDM - email
Curt Coover / CDM - email
James Freeman / DOJ - email
John Sither / DOJ - email
Tom Livers / DEQ - email
Jenny Chambers / DEQ - email
Thomas Stoops / DEQ - email
Daryl Reed / DEQ – email
Jonathan Morgan / DEQ - email
Lisa Dewitt / DEQ - email
Mary Capdeville / NRDP - email
Jim Ford / NRDP - email
Greg Mullen / NRDP - email
Pat Cunneen / NRDP - email
Ted Duaime / MBMG - email
Gary Icopini / MBMG - email
Robert Bylsma / UP - email
John Gilmour / UP - email
Bill Jackson / UP - email
Gary Honeyman / UP - email
Leo Berry / BNSF - email
Robert Lowry / BNSF – email
John Ashworth / BNSF - email
Brooke Kuhl / BNSF - email
Lauren Knickrehm / Kennedy/Jenks - email
Matthew Mavrinac / RARUS - email
Leean Greenwald / RARUS - email
Becky Summerville / Inland - email
Jon Sesso / BSB - email
Julia Crain / BSB - email
Eric Hassler / BSB - email

Dave Schultz / BSB - email
Pat Riordan / BSB - email
Molly Maffei / BSB - email
Gordon Hart / BSB - email
Josh Vincent / WET - email
Don Booth / AR Consultant - email
Craig Deeney / TREC - email
Scott Bradshaw / TREC - email
Brad Archibald / Pioneer - email
Joe McElroy / Pioneer - email
Pat Sampson / Pioneer - email
Dave Griffis / Pioneer - email
Mike Borduin / Pioneer - email
Leesla Jonart / Pioneer - email
CTEC of Butte - email
Montana Tech Library - hard copy

File: MiningSharePoint@bp.com - email
BPSOU SharePoint - upload

Differences Between BPSOU Surface Water QAPP, June 2018 and BPSOU Surface Water Monitoring Performed in 2018.

Site	Type of Site	Change from 2018 QAPP	Reason for Change
MPTP-CLV-1	Diagnostic	Identified as MPTP-CH-1 in Tables 3 & 4 of June 21, 2018 QAPP	Sampler installed at culvert location
SS-MPTP	Creek	Removed site from Figure 1. Site identified as SS-MPTP on Figure 1. Site is redundant with MPTP-CLV-1, which is displayed on Figure 2.	Removed SS-MPTP from Figure 1 to avoid confusion.
SS-01	Creek	Presented in Table 5 - Opportunistic Water Quality Monitoring Sites, Frequency and Sampling Method, which has been added to the QAPP	3/12/18: Manually sampled in response to turbid run-off which appeared to contain petroleum product
BG-CLV-01	Diagnostic		3/22/18: Manually sampled in response to turbid run-off which appeared to contain petroleum product
MSD-CLV-Casey	Diagnostic		5/4/18: ISCO 3700 sampler triggered to collect run-off occurring in response to Civic Center parking lot cleaning
WA-CLV-1	Diagnostic		5/4/18: ISCO 3700 sampler triggered to collect run-off occurring in response to Civic Center parking lot cleaning
WA-CLV-1	Diagnostic		7/28/18: ISCO 3700 sampler collected for unknown reason. Street cleaning, heavy irrigating at McGruff Park, and dust control at Parrot Tailings removal all occurring in this time period.
SS-CB8			9/7/18: Manually sampled due to presence of blue sludge type material following dye investigation of BSB sanitary sewers
WSD			9/7/18: Manually sampled in conjunction with SS-CB8 sample. No unusual material present at WSD.

SILVER BOW CREEK/BUTTE AREA NPL SITE

Final Butte Priority Soils Operable Unit Surface Water Monitoring Quality Assurance Project Plan (QAPP) 2018 Monitoring Period

Prepared for:

Atlantic Richfield Company
317 Anaconda Road
Butte, Montana 59701

Prepared by:

TREC Inc.
1800 West Koch, Suite 6
Bozeman, MT 59715

Revision 1

December 7, 2018

APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN REV 1 FOR
BUTTE PRIORITY SOILS OPERABLE UNIT SURFACE WATER MONITORING
SILVER BOW CREEK/BUTTE AREA NPL SITE

Approved: ______________________________ Date: ____________
Nikia Greene, Site Project Manager, EPA, Region 8

Approved: ______________________________ Date: ____________
Daryl Reed, Project Officer, Montana DEQ

Approved: ______________________________ Date: ____________
Terry Moore, Quality Assurance Manager, Atlantic Richfield Company

Approved: ______________________________ Date: ____________
Josh Bryson, Operations Project Manager, Atlantic Richfield Company

Plan is effective on date of last signature above.

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

QAPP/FSP/SAP for: *(check appropriate box)* GRANTEE CONTRACTOR EPA Other	**Entity** *(grantee, contract, EPA AO, EPA Program, Other)* Atlantic Richfield	**Regulatory Authority** **and/or** **Funding Mechanism**	___ **2 CFR 1500 for Grantee/Cooperative Agreements** ___ **48 CFR 46 for Contracts** ___ **Interagency Agreement** ___ **EPA/Court Order** ___ **EPA Program Funding** ___ **EPA Program Regulation** ___ **EPA CIO 2105**
Document Title *[Note: Title will be repeated in Header]*	Draft 2017 Butte Priority Soils Operable Unit Surface Water Monitoring Quality Assurance Project Plan		
QAPP/FSP/SAP Preparer	Padraic Stoy		
Period of Performance *(of QAPP/FSP/SAP)*	**January 2017-December 2018**	**Date Submitted for Review**	
EPA Project Officer **EPA Project Manager**	Nikia Greene	**PO Phone #** **PM Phone #**	(406) 457-5019
QA Program Reviewer or **Approving Official**	Nikia Greene	**Date of Review**	2/22/18

Documents Submitted for QAPP Review **(QA Reviewer must complete)*:***

1. QA Document(s) submitted for review:

QA Document	Document Date	Document Stand-alone	Document with QAPP
QAPP	**12/22/18**	**Yes** / No	
FSP		Yes / No	Yes / **No**
SAP		Yes / No	**Yes** / No
SOP(s)			**Yes** / No

2. WP/SOW/TO/PP/RP Date ___________

WP/SOW/TO/RP Performance Period _____________

3. QA document consistent with the:

WP/SOW/PP for grants? Yes / No

SOW/TO for contracts? Yes / No

4. QARF signed by R8 QAM Yes / No / NA

Funding Mechanism IA / contract / grant / NA

Amount _____________

Notes for Document Submittals:

1. A QAPP written by a Grantee, EPA, or Federal Partner must include for review:
Work Plan(WP) / Statement of Work (SOW) / Program Plan (PP) / Research Proposal (RP) and funding mechanism

2. A QAPP written by Contractor must include for review:

a) Copy of Task Order Work Assignment/SOW

b) Reference to a hard or electronic copy of the contractor's approved QMP

c) Copy of Contract SOW if no QMP has been approved

d) Copy of EPA/Court Order, if applicable

e) The QA Review must determine (with the EPA CO or PO) if a QARF was completed for the environmental data activity described in the QAPP.

3. a. Field Sampling Plan (FSP) and/or Sampling & Analyses Plan (SAP) must include the Project QAPP ***or*** must be a stand-alone QA document that contain all QAPP required elements (Project Management, Data Generation/Acquisition, Assessment and Oversight, and Data Validation and Usability).

c. SOPs must be submitted with a QA document that contains all QAPP required elements.

Summary of Comments *(highlight significant concerns/issues)*:

1. Attach this version of the document review crosswalk to the QAPP.
2. Comment #2
3. Comment #3

Draft 2017 Butte Priority Soils Operable Unit Surface Water Monitoring Quality Assurance Project Plan

4. **The** Atlantic Richfield **must address the comments in the Summary of Comments, as well as those identified in the Comment section(s) that includes a "Response (date)" and Resolved (date)".**

Element	**Acceptable** *Yes/No/NA*	**Page/ Section**	**Comments**
A. Project Management			
A1. Title and Approval Sheet			
a. Contains project title	Y	1st page	EPA: No comments.
b. Date and revision number line (for when needed)	N	viii	EPA: Add revision number to cover and signature pages. AR: Comment noted, and change made to cover and signature pages
c. Indicates organization's name	Y	cover and i	EPA: No comments.
d. Date and signature line for organization's project manager	Y	i	EPA: No comments.
e. Date and signature line for organization's QA manager	Y	i	EPA: No comments.
f. Other date and signatures lines, as needed	Y	i	EPA: No comments.
A2. Table of Contents			
a. Lists QA Project Plan information sections	Y	v-vii	EPA: No comments.
b. Document control information indicated	Y	v-vii	EPA: No comments.
A3. Distribution List			
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization	Y	ii-iv	EPA: No comments.
A4. Project/Task Organization			
a. Identifies key individuals involved in all major aspects of the project, including contractors	N	2.1	EPA: Add EPA and DEQ Management. AR: Comment noted, and addition made to Section 2.1
b. Discusses their responsibilities	N	2.1	EPA: Add EPA and DEQ Management. AR: Comment noted, and addition made to Section 2.1
c. Project QA Manager position indicates independence from unit generating data	Y	2.1	EPA: No comments.
d. Identifies individual responsible for maintaining the official, approved QA Project Plan	Y	2.1	EPA: No comments.
e. Organizational chart shows lines of authority and reporting responsibilities	N	App. A	EPA: Add EPA and DEQ Management. AR: Comment noted, and addition made to Appendix A
A5. Problem Definition/Background			

a. States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained	N	1.0	EPA: In Section 1.1, remove the reference to the Uniform Federal Policy for QAPPs (i.e., EPA 2005). This document is not in the format of a UFP-QAPP. Edit the reference section accordingly. Add the following to Section 1.0: "This QAPP has been developed in accordance with the *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5* (EPA 2001), the *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G4* (EPA 2006), and the *EPA Region 8 Quality Assurance Document Review Crosswalk* checklist (EPA 2016)." AR: Comment noted, and change made to Section 1.0
b. Clearly explains the reason (site background or historical context) for initiating this project	N	2.2	EPA: Add text citing ROD actions, goals, and objectives. AR: Comment noted, and change made to Section 2.2
c. Identifies regulatory information, applicable criteria, action limits, etc. necessary to the project	N	2.4.1, Table 4	EPA: Tables 2 and 3 should be moved to Section 3. AR: Comment noted, and tables renumbered and moved to Section 3
A6. Project/Task Description			
a. Summarizes work to be performed, for example, measurements to be made, data files to be obtained, etc., that support the project's goals	N	2.3, Table 1	EPA: In Table 1 regarding data packages, the data packages should be Level IV, not Level 2. AR: Comment noted, and change made to Section 2.3 and Table 3
b. Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments	N	2.3, Table 1	EPA: Provide a brief summary of the overall sampling schedule in Table 1. AR: Comment noted, and change made to Table 1
c. Details geographical locations to be studied, including maps where possible	Y	2.4.1, Step 1	EPA: No comments.
d. Discusses resource and time constraints, if applicable	Y	2.4, Step 1	EPA: Not Applicable
A7. Quality Objectives and Criteria			
a. Identifies - performance/measurement criteria for all information to be collected and acceptance criteria for information obtained from previous studies, - including project action limits and laboratory detection limits and - range of anticipated concentrations of each parameter of interest	N	2.4.1, Table 8 3.4.2, Tables 2 and 3	Table 8, Lab QC criteria, Tables 2 and 3 cited in Section 3.4.2 contains detection limits. EPA: In the second paragraph, the Step 5 DQO title should be "Develop the Analytic Approach" and Step 7 should be "Develop the Plan for Obtaining Data." AR: Comment noted, and change made to Section 3.4.2.

b. Discusses precision	N	2.4.2, Precision	Table 7 defines formula. EPA: In the second paragraph, slightly reward as follows: "…control spike samples (LCS/LCSD), and/or laboratory duplicate (LD) samples." AR: Comment noted, and change made to Section 2.4.2.
c. Addresses bias	Y	2.4.2, Accuracy/Bias	EPA: In the last paragraph, there should be a space between "Table 8" and "Surface".
d. Discusses representativeness	N	2.4.2, Representativeness	EPA: Please explain how RPDs would be used with field blank results. AR: Comment noted, and change made to Section 2.4.2.
e. Identifies the need for completeness	Y	2.4.2	EPA: No comments.
f. Describes the need for comparability	Y	2.4.2	EPA: No comments.
g. Discusses desired method sensitivity	N	2.4.2	EPA: A section on sensitivity should be added to this section and other applicable QAPP sections where PARCCS parameters are discussed. AR: Comment noted, and change made to Section 2.4.2.
A8. Special Training/Certifications			
a. Identifies any project personnel specialized training or certifications	N	2.5	EPA: Add HAZWOPER training as a requirement. AR: Comment noted, and change made to Section 2.5.
b. Discusses how this training will be provided	Y	2.5	EPA: No comments.
c. Indicates personnel responsible for assuring training/certifications are satisfied	Y	2.5	EPA: No comments.
d. identifies where this information is documented	Y	2.5	EPA: No comments.
A9. Documentation and Records			
a. Identifies report format and summarizes all data report package information	Y	2.6.5 & 4.3	EPA: No comments.
b. Lists all other project documents, records, and electronic files that will be produced	Y	2.6	EPA: No comments.
c. Identifies where project information should be kept and for how long	Y	2.6	EPA: No comments.
d. Discusses back up plans for records stored electronically	Y	2.6	EPA: No comments.
e. States how individuals identified in A3 will receive the most current copy of the approved QA Project Plan, identifying the individual responsible for this		2.6.6	EPA: In a suitable location, such as Section 2.1 or 2.6.6, specify how the QAPP will be distributed and the individual responsible for this. AR: Comment noted, and change made to Section 2.1
B. Data Generation/Acquisition			

B1. Sampling Process Design (Experimental Design)			
a. Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample	Y	3.1	EPA: EPA: In the first paragraph, there should be a space between "Objectives" and "2.4.1". AR: Comment noted, and change made to Section 3.1
b. Details the type and total number of sample types/matrix or test runs/trials expected and needed	Y	3.1.1, Tables 5 & 6	EPA: No comments.
c. Indicates where samples should be taken, how sites will be identified/located	Y	3.1.1, Tables 5 & 6	EPA: No comments.
d. Discusses what to do if sampling sites become inaccessible	Y	3.1.1	EPA: No comments.
e. Identifies project activity schedules such as each sampling event, times samples should be sent to the laboratory, etc.	Y	3.1.1	EPA: No comments.
f. Specifies what information is critical and what is for informational purposes only	Y	3.1.1	EPA: No comments.
g. Identifies sources of variability and how this variability should be reconciled with project information	Y	3.1.1	EPA: No comments.
B2. Sampling Methods			
a. Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken	Y	3.2.1, Table 7	EPA: No comments.
b. Indicates how each sample/matrix type should be collected	N	3.2.2, 3.2.2.1	EPA: Section 3.2.2.1 states that weather measurements will be collected in accordance with "TREC or CFRSSI SOPS", however, there is no SOP cited for weather measurements. Please add the SOP or add further details on weather instrument operation to Section 3.2.2.1. AR: Comment noted, and change made to Section 3.2.2.1.
c. If in situ monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data	Y	3.2.2	EPA: No comments.
d. If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages	Y	3.2.2.1	EPA: No comments.
e. Indicates how samples are to be homogenized, composited, split, or filtered, if needed	Y	3.2.2.2, SOPS	EPA: No comments.

f. Indicates what sample containers and sample volumes should be used	N	3.2.2.3	EPA: The sample containers to be used need to be clearly specified in a table and/or the main body of the QAPP. AR: Comment noted, and change made to Section 3.2.2.3 and Tables Index.
g. Identifies whether samples should be preserved and indicates methods that should be followed	N	3.2.2.3	EPA: The sample preservatives need to be clearly specified in a table and/or the main body of the QAPP. AR: Comment noted, and change made to Section 3.2.2.3 and Table Index.
h. Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of	Y	3.2.2.3, 3.5.1	EPA: No comments.
i. Identifies any equipment and support facilities needed	Y	3.2.3	EPA: No comments.
j. Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented	Y	4.1	EPA: No comments.
B3. Sample Handling and Custody			
a. States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for in-situ or continuous monitoring, the maximum time before retrieval of information	Y	3.3.1, Tables 2 & 3	EPA: No comments.
b. Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)	N	3.3.2	EPA: In the fifth sentence, it is stated "samples will be delivered/shipped within two weeks of sample collection." It should be noted in this paragraph though that certain analyses have a shorter holding time, such as TDS and TSS, so samples would need to be shipped before two weeks after collection in order to ensure holding times will be met. AR: Comment noted, and change made to Section 3.3.2.
c. Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible	Y	3.3.3	EPA: No comments.
d. Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan	N	3.3.4	EPA: The schema for the unique sampling ID should be described in this section AR: Comment noted, and change made to Section 3.3.4.
e. Identifies chain-of-custody procedures and includes form to track custody	N	3.3.5	EPA: The example chain of custody form was not contained in Appendix C. Please add example. AR: Comment noted, and change made to Appendix C.
B4. Analytical Methods			

a. Identifies all analytical SOPs (field, laboratory and/or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures	N	2.4.2, 3.4.1, 3.4.2, Tables 2 & 3	EPA: In the first paragraph of Section 2.4.2, the QAPP should reference the EPA SOW ISMO2.4 (2016) as well as ISMO2.3 in case that is followed by the laboratories. In addition, the reference should be updated accordingly. AR: Comment noted, and change made to Section 2.4.2.
b. Identifies equipment or instrumentation needed	Y	3.4.3	EPA: No comments.
c. Specifies any specific method performance criteria	N/A	N/A	N/A
d. Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation	Y	3.5.2, Table 8 4.1	EPA: No comments.
e. Identifies sample disposal procedures	Y	3.4.4	EPA: No comments.
f. Specifies laboratory turnaround times needed	N	5.1.3	EPA: Laboratory turnaround times were not specified. AR: Comment noted and change made to Section 5.1.3.
g. Provides method validation information and SOPs for nonstandard methods	N/A	N/A	N/A
B5. Quality Control			
a. For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency	Y	3.5.1, 3.5.2	EPA: In the third to last sentence of the Field Blank paragraph, replace "handle" with "handled". AR: Comment noted, and change made to Section 3.5.1.
b. Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented	N	3.5.2, Table 8	EPA: In the Matrix Spike paragraph, a discussion of MSD should be added to this discussion. In Table 8, the National Functional Guidelines reference should be updated to 2017. AR: Comment noted, and change made to Section 3.5.2 and Table 8.
c. Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data	Y	2.4.2, Table 7	EPA: No comments.
B6. Instrument/Equipment Testing, Inspection, and Maintenance			
a. Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this	Y	3.6.1, 3.6.2	EPA: No comments.
b. Identifies testing criteria	Y	3.6.1, 3.6.2	EPA: No comments.
c. Notes availability and location of spare parts	Y	3.2.3	EPA: No comments.
d. Indicates procedures in place for inspecting equipment before usage	Y	3.6.1, 3.6.2	EPA: No comments.

e. Identifies individual(s) responsible for testing, inspection and maintenance	N	3.6.1, 3.6.2	EPA: Specify the individual(s) responsible. AR: Comment noted, and change made to Section 3.6.1 and 3.6.2.
f. Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented	Y	3.2, 3.6.1, 3.6.2, 4.1	EPA: No comments.
B7. Instrument/Equipment Calibration and Frequency			
a. Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration	Y	3.7	EPA: No comments.
b. Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment	Y	3.7	EPA: No comments.
c. Identifies how deficiencies should be resolved and documented	Y	3.6.1 3.7, 4.1	EPA: No comments.
B8. Inspection/Acceptance for Supplies and Consumables			
a. Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials	Y	3.8	EPA: No comments.
b. Identifies the individual(s) responsible for this	Y	3.8	EPA: No comments.
B9. Use of Existing Data (Non-direct Measurements)			
a. Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used	N/A	N/A	N/A
b. Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project	N/A	N/A	N/A
c. Indicates the acceptance criteria for these data sources and/or models	N/A	N/A	N/A
d. Identifies key resources/support facilities needed	N/A	N/A	N/A
e. Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing	N/A	N/A	N/A
B10. Data Management			
a. Describes data management scheme from field to final use and storage	Y	3.9	EPA: No comments.

b. Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs	N	3.9	EPA: Please discuss and add reference to the BPSOU Data Management Plan (in preparation). AR: Comment noted, and change made to Section 3.9.
c. Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately	N	3.9	EPA: Against the DMP (in preparation). AR: Comment noted, and change made to Section 3.9.
d. Identifies individual(s) responsible for this	N	3.9	EPA: Identify individual(s) responsible for data management. AR: Comment noted, and change made to Section 3.9.
e. Describes the process for data archival and retrieval	N	3.9	EPA: Specify the process for retrieving data. AR: Comment noted, and addition added to Section 3.9.
f. Describes procedures to demonstrate acceptability of hardware and software configurations	N/A	N/A	N/A
g. Attaches checklists and forms that should be used	N	Appendix D	EPA: In Exhibit 1 of Appendix D, the Validation Criteria should update the reference to the National Functional Guidelines to 2017. AR: Comment noted, and change made to Appendix D.
C. Assessment and Oversight			
C1. Assessments and Response Actions			
a. Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates	Y	4.0	No dates included. EPA: No comments.
b. Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process	Y	4.0, 4.1, 4.2	EPA: No comments.
c. Describes how and to whom assessment information should be reported	Y	4.0, 4.1, 4.2	EPA: No comments.
d. Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented	Y	4.1, 4.2	EPA: No comments.
C2. Reports to Management			
a. Identifies what project QA status reports are needed and how frequently	Y	4.3	EPA: No comments.
b. Identifies who should write these reports and who should receive this information	Y	4.3	EPA: No comments.
D. Data Validation and Usability			

D1. Data Review, Verification, and Validation			
Describes criteria that should be used for accepting, rejecting, or qualifying project data	N	5.2.2	EPA: The reference for the National Functional Guidelines is missing the word "Methods". Please add a discussion of how data are identified as screening/enforcement/rejected after data validation and usage of the Level A/B screening checklist. AR: Comment noted, and change made to Section 5.2.2.
D2. Verification and Validation Methods			
a. Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any	N	5.2.2	EPA: Please expand on how "data quality review" and "data quality assessment" differ or complement each other in the process of determining whether DQOs have been met. Is data quality review referring more to the data validation process? Please add clarifying text. In the Qualifiers discussion, add a reference to Exhibit 3. AR: Comment noted, and change made to Section 5.2.2.
b. Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.	Y	5.1.1, 5.1.2, 5.2.2	EPA: No comments.
c. Identifies issue resolution process, and method and individual responsible for conveying these results to data users	Y	5.1.1 5.1.2	EPA: No comments.
d. Attaches checklists, forms, and calculations	Y	Appendix E	EPA: No comments.
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data	Y	5.2.2	EPA: No comments.
b. Describes how limitations on data use should be reported to the data users	Y	5.2.1 5.2.2	EPA: No comments.

DISTRIBUTION LIST

Silver Bow Creek/Butte Area NPL Site
Butte Priority Soils Operable Unit Surface Water Monitoring Quality Assurance Project Plan (QAPP)
Butte, Silver Bow County, Montana

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REVISION SUMMARY

Revision No.	Author	Version	Description	Date
1	TREC, Inc.	1	Added Table (Table 5) and revised Figures 1&2 to include opportunistic sites monitored in 2018.	12/7/18

LIST OF ACRONYMS AND ABBREVIATIONS

APHA	American Public Health Association
ARAR	Applicable Relevant and Appropriate Requirements
ARCO	Atlantic Richfield Company
AROPM	Atlantic Richfield Operations Project Manager
ASTM	American Society of Testing and Materials
BMFOU	Butte Mine Flooding Operable Unit
BPSOU	Butte Priority Soils Operable Unit
BTC	Blacktail Creek
BTL	Butte Treatment Lagoons
CaCO3	Calcium Carbonate
CAP	Corrective Action Plan
CAR	Corrective Action Report
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFRSSI	Clark Fork River Superfund Site Investigations
CGWA	Controlled Groundwater Area
CLP	Contract Laboratory Program
COC	Contaminant of Concern
CPM	Contractor Project Manager
DEQ	Department of Environmental Quality
DI	Deionized Water
DMP	Data Management Plan
DO	Dissolved Oxygen
DQA	Data Quality Assessment
DQO	Data Quality Objectives
DSR	Data Summary Report
DTW	Depth to Water
ECB	External Contamination Blank
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FB	Field Blank
GIS	Geographic Information System
GPS	Global Positioning System
HDPE	High-Density Polyethylene
HSP	Health and Safety Plan
HSSE	Health Safety Security and Environment
ICB	Initial Calibration Blank
ICS	Interference Check Sample
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IM	Integrity Management
LaMP	Laboratory Management Program

LAO	Lower Area One
LAP	Lab Analysis Plan
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LD	Laboratory Duplicate
LOQ	Limit of Quantification
LTIM	Long Term Inspection and Maintenance
MB	Method Blank
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSD	Metro Storm Drain
NPL	National Priorities List
O&M	Operations & Maintenance
ORP	Oxidation-Reduction Potential
pH	Hydrogen Ion Concentration
PPE	Personal Protective Equipment
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSR	Quality System Review
RA	Remedial Action
RAO	Remedial Action Objective
RL	Reporting Limit
ROD	Record of Decision
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SBC	Silver Bow Creek
SC	Specific Conductivity
SD	Serial Dilution
SEIP	Statistical Evaluation and Implementation Plan
SOP	Standard Operating Procedure
SRM	Standard Reference Material
SU	Standard Unit
TI	Technical Impracticability
UTL	Upper Tolerance Limit

1.0 INTRODUCTION

The purpose of this Quality Assurance Project Plan (QAPP) is to provide guidance for collecting enforcement quality data for Surface Water monitoring activities at the Butte Priority Soils Operable Unit within the Silver Bow Creek/Butte Area National Priorities List (NPL) Site and to reference the documents necessary to describe the quality assurance and quality control (QA/QC) policies and procedures to be used during data collection and analysis. This QAPP has been developed in accordance with the EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA 2001), the Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA AQ/G-4 (EPA 2006), and the EPA Region 8 Quality Assurance Document Review Crosswalk checklist (EPA 2016). This QAPP was prepared in a manner consistent with the Silver Bow Creek/Butte Area NPL Site Quality Management Plan (Atlantic Richfield, 2018) and includes the four basic element groups:

- Project Management and Objectives;
- Measurement and Data Acquisition;
- Assessment and Oversight; and
- Data Review.

The four sections below provide these project plan elements and include the appropriate content needed for planning the sampling and analysis within the site. The sections in this framework QAPP expand and reference information in other site wide documents to comply with the Uniform Federal Policy for Quality Assurance Project Plans guidance and to present project specific requirements.

2.0 PROJECT MANAGEMENT

This section addresses project administrative functions and project concerns, goals and approaches to be followed during sampling activities on the site.

2.1 Project Organization and Responsibilities

An example organizational chart showing the overall organization of the project team is provided in Appendix A. Responsibilities of key individuals comprising a project team are described below.

<u>Atlantic Richfield Quality Assurance Manager (QAM) – Terry Moore (Atlantic Richfield Company)</u>

The QAM has direct access to management at a level where appropriate action can be affected. The QAM interfaces with the Atlantic Richfield Operations Project Manager (AROPM) for Atlantic Richfield policies regarding quality and has a direct line of communication to the Atlantic Richfield project coordinator. Day-to-day operations are coordinated between the QAM and the AROPM. The QAM shall approve the selection of the Quality Assurance Officer (QAO), made by the AROPM. QAOs have a direct line of communication to the QAM to ensure required authority and organizational freedom to meet QA objectives, including sufficient independence from cost and schedule considerations.

The QAM has the responsibility and authority for the administration and maintenance of this QAPP. The QAM has the authority and responsibility to ensure that appropriate levels of quality management are established and effectively implemented for the site by participating in regular site reviews either through site visits or through site review reports prepared by the QAO. Summary reports of such reviews regarding the effectiveness of quality system implementation will be provided to the applicable ARPM by the QAM.

Atlantic Richfield Operations Project Manager (AROPM)–Josh Bryson (Atlantic Richfield Company)

The Operations Project Manager monitors the performance of the contractor(s). The Operations Project Manager consults with the Contractor Quality Assurance Officer and Contractor Project Manager(s) on deficiencies and aids in finalizing resolution actions.

Contractor Project Manager (CPM) – Scott Bradshaw (TREC, Inc.)

The CPM is responsible for scheduling all sampling work to be completed and ensuring that the work is performed in accordance with the requirements contained herein. The CPM is also responsible for consulting with the quality assurance personnel identified for the project regarding any deficiencies and finalizing resolution actions.

Field Team Leader – Alice Drew-Davies (TREC, Inc.)

The Field Team Leader ensures that the QAPP has been reviewed by all members of the field team and is properly followed when implementing field activities. The Field Team Leader will conduct daily safety meetings, assist in field activities and document activities in the logbook. The Field Team Leader is responsible for equipment, problem solving, decision making in the field and technical aspects of project. In addition, the field team leader provides "on-the-ground" overview of project implementation by observing site activities to ensure compliance with technical project requirements, Health Safety Security and Environment (HSSE) requirements, and the Site Specific Health and Safety Plan, identifies potential Integrity Management (IM) issues, as appropriate, and prepares required project documentation.

Contractor Quality Assurance Officer (QAO) - Janelle Garza (TREC, Inc.)

The QAO is responsible for field and laboratory data review and evaluation of data quality, including conducting on-site reviews and preparing site review reports for the QAM.

The QAO represents their assigned projects as the primary spokesperson on matters relating to quality management system implementation. In matters of project quality assurance (QA), this individual will have a direct line of communication to the QAM.

The QAO is authorized to stop work if, in the judgment of that individual, the work is performed contrary to or in the absence of prescribed quality controls, or approved methods, and further work would make it difficult or impossible to obtain acceptable results. The QAO may also stop work if completion of quality corrective actions is not acceptable.

QAOs are responsible for evaluating data and information from instances of nonconformance, inspection reports, surveillance reports, audit and assessment reports, quality system reviews (QSRs), corrective action reports (CARs), corrective action plans (CAPs), stop work orders, and other sources. These data should be used to identify trends or conditions averse to quality, which shall be brought to the attention of the QAM

Project Safety and Health Manager – Nicole Santifer (TREC, Inc.)

The Project Safety and Health Manager will conduct the initial safety meeting prior to starting fieldwork for the QAPP. The Safety and Health Manager will ensure that work crews comply with all site health and safety requirements and will revise the Health and Safety Plan (HSP), if necessary.

Contract Laboratory – Pace Analytical Labs

Contract Laboratory QA personnel are familiar with the approved QAPP and are available to perform the work as specified. Contract Laboratory personnel are responsible for reviewing final analytical reports produced by the laboratory, coordinating scheduling of laboratory analyses and supervising in-house chain-of-custody procedures.

Environmental Protection Agency (EPA) and Montana Department of Environmental Quality (MDEQ)

The EPA, in consultation with the MDEQ, has direct management over the process and procedures of the project. Final reports are submitted to the agencies for comment and review. The agencies will address any questions and concerns to the draft document and procedures throughout the project. EPA has ability to approve the QAPP as final.

This QAPP will be distributed by the AROPM to EPA and MDEQ via hard copy, and all other necessary parties will be sent an electronic copy.

2.2 Problem Definition and Background

The BPSOU covers approximately 5 square miles and includes the town of Walkerville, along with a large portion of the city of Butte. A small stream, Silver Bow Creek (SBC), runs through the BPSOU. Upper Silver Bow Creek (uSBC), previously designated as the Metro Storm Drain (MSD), joins Blacktail Creek (BTC) to form SBC. Placer mining for silver and gold began in the Butte area in 1864, and by the 1870s multiple silver and copper mines, mills, and smelting facilities had been established in the area. Over 284 million pounds of copper had been produced by the Butte district by 1910, and the associated wastes "*were disposed of in ponds or dumped in Silver Bow Creek*" (EPA, 2006d). Mine waste, including tailings and waste rock dumps, accumulated across the Butte Hill for more than a century as mining and associated industries flourished. These accumulations impacted Silver Bow Creek (SBC) via direct run-off to the creek, and infiltration to the alluvial aquifer, with that groundwater eventually re-expressing as surface water in the creek. As a result of these impacts, SBC was designated as a Superfund site by the Environmental Protection Agency (EPA) in September 1983. Given that SBC was impacted by wastes within the Butte area, the Silver Bow Creek Site was expanded to include the Butte Area in 1987.

Multiple remedial actions have been instituted to impact Silver Bow Creek water quality. From 1992-1997, over one million cubic yards of mine waste was removed in the western part of the BPSOU. From 1996-1998 storm water issues on the Butte Hill were addressed through sediment basins, channelizing flow, regrading, revegetation, and reclamation. In 2003 Missoula Gulch wet weather flows were segregated from normal flows to allow gravitational removal of solids and metals in catch basins. From 2003-2005 the MSD groundwater capture system was constructed to separate groundwater from wet weather flow in the MSD. In 2006 additional Missoula Gulch BMPs were implemented to divert normal flow to the Butte Treatment Lagoons (BTL) and to enhance storm water retention of flows exiting catch basin 9. 2010 saw 7,200 cubic yards of mining impacted material removed from the streambanks at the confluence of BTC and the MSD, as well as rip-rapping the streambanks and revegetating the area near the confluence after the removal. Between 2011 and 2013, Hydrodynamic devices were installed in stormwater trunk lines at the base of the Butte Hill to capture sediments before water is discharged to SBC. The above remedial actions represent the subset most directly impacting SBC water quality of all remedial actions performed.

The Record of Decision (ROD) (EPA, 2006d), distributed by the EPA, lays out guidelines for selected remedies for surface water within BPSOU. The goals of the remedies are to protect human health, environmental health, and reduce COC concentrations to quality standards in Grove Gulch, Blacktail Creek, and Silver Bow Creek. The ROD states, the selected Remedy for surface water consists of the following components:

1. The Surface Water Management Program, which utilizes BMPs to address contaminated storm water runoff and improve storm water quality.
2. Excavation and removal of contaminated sediments from the stream bed, banks, and adjacent floodplain along Blacktail Creek and Silver Bow Creek, from just above the confluence of Blacktail Creek and Metro Storm Drain to the beginning of the reconstructed Silver Bow Creek floodplain at Butte Treatment Lagoons (BTL). Following removal of the in-stream sediments, further evaluation of surface water quality in this area will be conducted. If groundwater inflow is found to adversely affect surface water quality, additional hydraulic controls and groundwater capture shall be implemented.
3. Capturing and treating storm water runoff up to a specified maximum storm event, if BMPs implemented under the Surface Water Management Program do not achieve the goal of meeting surface water standards in Silver Bow Creek, Grove Gulch, and Blacktail Creek during storm water events.
4. Hydraulic control, capture, and treatment of contaminated groundwater to prevent its discharge to Silver Bow Creek surface water.
5. In-stream flow augmentation as appropriate. Flow augmentation will not be considered until the major remedial components described in this ROD are designed and implemented.

2.3 Project Description and Schedule

The purpose of BPSOU surface water monitoring is to assess compliance with performance standards and employ iterative monitoring and BMP implementation with the ultimate goal of meeting performance standards. Additionally, the plan must yield data to discern surface water quality, and quantity; and that data must be of adequate quality to enable remedy review.

Specific QAPP objectives are to:

1. Present the procedures required to collect surface water data necessary to assess compliance with performance standards; and
2. Describe specific requirements for collecting and analyzing surface water data.

The monitoring network specifically targets the following surface water areas and sub-drainages in order to meet these objectives:

- Silver Bow Creek
- Blacktail Creek
- uSBC
- Buffalo Gulch Sub-drainage
- East Buffalo Gulch
- Anaconda Road-Butte Brewery
- Warren Avenue Sub-drainage
- Texas Avenue Sub-drainage
- Locust Avenue Sub-drainage
- Missoula Gulch Sub-drainage

A summary of the tasks is provided in

Table 1 below.

Table 1 - Summary of Project Tasks

Water Quality Sampling Tasks: Water quality samples will be collected during normal flow conditions monthly using the method described in Section 3.2.2.3. Water quality samples will be collected during wet weather conditions as defined in the Wet Weather Criteria SOP in Appendix B, using the method described in Section 5.1.2.
Sampling Schedule: Normal flow sampling will take place once a month, January through December, at 10 locations along Silver Bow and Blacktail Creek. Wet weather sampling will take place up to three times a month, March through October, when flow at SS-04 exceeds 35 cfs, flow at SS-07 exceeds 50 cfs, or criteria in Wet Weather Trigger SOP are met at eight creek sites and 14 diagnostic stations.
Flow Measurement Tasks: Flow measurements will be taken during normal flow water quality sampling. For wet weather water quality sampling, continuous flow recorders and stage-discharge curves will be used to determine flow.
Analysis Tasks: Laboratory analysis for water quality parameters consistent with EPA test methods for organic and inorganic constituents including: total and dissolved metals and metalloids, anions (nitrate + nitrite, phosphorous, and sulfate), alkalinity, dissolved organic carbon, hardness, nutrients (ammonia and total kjeldahl nitrogen (TKN)), and total dissolved and suspended solids in accordance with EPA Test methods for organic and inorganic constituents.
Quality Control Tasks: All laboratory analytical matrices will have the following QC samples analyzed: 1 field duplicate for every 20 primary samples, and 1 field blank collected for every 20 primary samples if sampling equipment is reused across sample locations. All analytical methods will perform: initial calibration, continuing calibration, initial calibration blanks, continuing calibration blanks, interference check sample, method blanks, laboratory control sample, laboratory duplicate sample, matrix spike, and serial dilution, as applicable to the method and the sample matrix.
Data Management Tasks: Analytical data will be reviewed and evaluated for quality by the project's Quality Assurance Officer and placed in the site database.
Documentation and Records: All samples collected will have GPS locations, records of each sample collected and all field measurements appropriately documented.
Data Packages: All data packages are Level II and will include results in mg/L, or other applicable units, of all constituents analyzed.

2.4 Quality Objectives and Criteria

This section discusses the internal quality control (QC) and review procedures used to ensure that all data collected for this project are of a known quality.

2.4.1 Data Quality Objectives

The DQO process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. Each step of the DQO process defines criteria that will be used to establish the final data collection design following the Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA, 2006a)

The EPA DQO process consists of seven steps, as follows:

Step 1: State the Problem;

Step 2: Identify the Goals of the Study;

Step 3: Identify Information Inputs;

Step 4: Define the Boundaries of the Study;

Step 5: Develop the Analytical Approach;

Step 6: Specify Performance and Acceptance Criteria; and

Step 7: Develop the Plan for Collecting Data.

The DQOs, which will be used to guide the data collection and analysis activities, are as follows:

Step 1: State the Problem.

"The purpose of this step is to describe the problem to be studied so that the focus of the investigation will not be ambiguous."

Surface water in Blacktail and Silver Bow Creek have been impacted by past mining activities. Multiple remedial actions have been instituted to impact Silver Bow Creek water quality including:

- Removing mine waste from the western part of the BPSOU and the confluence of BTC and MSD;
- Missoula Gulch wet weather flows were segregated from normal flows to allow gravitational removal of solids and metals in catch basins as well as diversion for treatment in Butte Treatment Lagoons (BTL);
- The MSD groundwater capture system was constructed to separate groundwater from wet weather flow in the MSD; and
- Hydrodynamic devices were installed in stormwater trunk lines at the base of the Butte Hill to capture sediments before water is discharged to SBC.

In order to determine the effectiveness of these past BMPs and necessity of additional BMPs, a monitoring program that assesses water quality compliance and assesses performance monitoring standards during normal and wet weather flows will be implemented. Monitoring will occur for Contaminants of Concern (COCs) for surface water that include aluminum, arsenic, cadmium, copper, lead, mercury, silver, and zinc. Water quality and flow data are necessary to characterize normal and wet weather flows in SBC and BTC. This data will subsequently be used to monitor water quality compliance and assess the efficacy of implemented BMPs.

Step 2: Identify the Goal of the Study.

"This step identifies what questions the study will attempt to resolve and what actions may result."

The key questions may be stated as follows:

1. What are the ongoing discharge rates and concentrations of contaminants of concern in surface water within the upstream of the operable unit?

2. What are the flow rates and water quality in Blacktail and Silver Bow Creeks during normal flow and wet weather conditions?
3. What is the variability of water quality and discharge in surface water within the upstream of the operable unit?
4. What are the flow rates and concentrations of contaminants of concern in storm water within and exiting the municipal storm water system within the operable unit?
5. What are the precipitation and snowpack conditions that may affect surface water discharge in the operable unit?

Step 3: Identify Information Inputs.

"The purpose of this step is to identify the informational variables that will be required to resolve the study goals and determine which variables require environmental measurements."

The following data will be collected to supplement existing data in order to address the goals of the surface water monitoring program. There will be two main areas monitored: within the Creek (SBC and BTC) and Diagnostic Monitoring in BPSOU sub-drainages.

- Weather Monitoring Data
    - Continuous data including wind speed and direction, temperature, and precipitation
- Surface water flow monitoring data
    - Creek Normal Flow
        - Conduct manual flow measurements. Utilize data to develop stage-discharge curves
    - Creek Wet Weather
        - Incorporate continuous stage monitors and apply to stage-discharge curves to determine flow
    - Sub-Drainage Wet Weather Diagnostic
        - Incorporate continuous flow monitors
        - Opportunistic manual flow measurements may be collected to supplement the continuous flow monitoring as necessary.
- Surface water quality monitoring data
    - Creek Normal flow
        - Enforcement-status laboratory analyses for COC metals.
        - Field measurements of pH, specific conductance (SC), dissolved oxygen (DO), and temperature.
    - Creek Wet Weather
        - Enforcement-status laboratory analyses for COC metals.
        - Continuous in-stream pH measurement.
    - Sub-Drainage Wet Weather Diagnostic
        - Enforcement level laboratory analyses for COC metals.

Data will be obtained from sampling as described in *Section 3.0: Measurement and Data Acquisition*. The data will be used with previously collected data to assess water quality trends in SBC and BTC. Applicable water quality standards are provided in

Table 2 - Creek Monitoring Performance Criteria

Analyte	Normal Flow Standard (ug/L)[1]	WW Flow Standard (ug/L)[2]
Dissolved Aluminum	87	750
Total Arsenic	10	340
Total Cadmium	0.097	0.52
Total Copper	2.85	3.79
Total Iron	1000	1000
Total Lead	0.545	13.98
Total Mercury	0.05	1.7
Total Silver		0.374
Total Zinc	37	37

[1] Normal Flow Standard based on more conservative of either DEQ7 Chronic Aquatic Life Standard (using hardness of 25 mg/L) or Human Health Standard
[2] WW Flow Standard based on DEQ 7 Acute Aquatic Life Standard (using hardness of 25 mg/L)

Step 4: Define the Boundaries of the Study.

"The purpose of this step is to identify the target population of interest and specify the spatial and temporal features of that population that are pertinent for decision-making."

Surface water monitoring will occur within and upstream of the BPSOU boundary, along BTC and SBC from Harrison Avenue to the western terminus of the BPSOU, and within SBC and BTC sub-drainages. Water quality sampling will be performed during wet weather when monitoring is not impeded by freezing conditions, generally between April and September, and year-round during normal flow conditions. Continuous stage and flow monitoring will occur throughout the year regardless of conditions.

Creek normal flow water quality sampling and flow monitoring will be done monthly, a total of 12 times per year. Normal flow events collected during the months of February through June will likely be high normal flow events with higher than average incoming flows from BTC, depending on snowpack, precipitation, and temperature. Normal Flow monitoring stations, specified in Table 3 and Table 4, were selected to monitor seasonal and perennial drainages during normal flow. Stage and flow monitoring stations are included in Table 3, Table 4, and Figure 1 and as described in Section 3.

Creek wet weather sampling is not identified during freezing conditions due to the small probability that a storm will occur and the difficulties associated with sampling equipment functionality under freezing condition. Absent freezing condition, generally between April and September, monitoring will occur at locations specified in Table 3, Table 4, and Figure 1 and as described in Section 3, to assess conditions within the stream at compliance stations or to evaluate BMP efficacy. Wet Weather sampling criteria are described in an attached SOP in Appendix B. Creek stage data will be collected continuously.

Sub-drainage wet weather diagnostic sampling and monitoring will be performed during wet weather when monitoring is not impeded by freezing conditions, generally between April and September, at various elevations within BTC and SBC sub-drainages. BPSOU sub-drainage sampling will occur throughout the wet weather season. Sub-drainage wet weather diagnostic sampling and monitoring stations are shown in Figure 2 and listed in Table 3 and Table 4, and as described in Section 3. Sub-drainage flow data will be collected continuously.

Opportunistic samples may be collected throughout the monitoring season in response to observed unusual in-channel conditions. These may include run-off occurring in the absence of precipitation or discolored water within a channel. Opportunistic monitoring stations are detailed in Table 5 and displayed on Figures 1 and 2.

Table 3- Flow Measurement Monitoring Sites, Frequency, and Monitoring Method (located in Table Index)

Table 4 - Water Quality Monitoring Sites, Frequency, and Sampling Method (Located in Table Index)

Table 5 - Opportunistic Water Quality Monitoring Sites, Frequency, and Sampling Method (Located in Table Index)

Table 6 – Monitoring Site Coordinates and Location Description (Located in Table Index)

Step 5: Develop the Analytic Approach.

"The purpose of this step is to define the parameters of interest, specify action levels, and integrate any previous DQO inputs into a single statement that describes a logical basis for choosing among alternative actions."

Normal flow creek samples will be collected once a month, January through December, weather permitting. Field measured parameters include stage, flow (completed after sampling to minimize sediment mobilization), water temperature, specific conductance, and pH. Samples will be collected with clean high-density polyethylene bottles. Appropriate preservative (nitric acid for metals, sulfuric acid for DOC, NO_2/NO_3, NH_3, TKN, and Phosphorus) will be added to the sample bottle. Samples will be sent to the lab and analyzed for total and dissolved fraction of multiple metals, inorganic, organic, and general laboratory parameters.

Wet weather samples will be collected using automated samplers (ISCO 3700 and D-TECs) set to collect within the first half hour of a wet weather event. Once triggered to sample, ISCO automated samplers will collect four samples hourly throughout the runoff hydrograph. D-TEC automated samplers will collect one sample at the beginning of the runoff hydrograph and will be submitted for analysis in the event of an ISCO sampler failure. Samples will be retrieved within 24 hours of sampling and transported to the office for sample preparation. Appropriate preservative (nitric acid for metals, sulfuric acid for DOC, NO_2/NO_3, NH_3, TKN, and Phosphorus) will be added to the sample bottle. Samples will be sent to the lab and analyzed for total and dissolved fraction of multiple metals, inorganic, organic, and general laboratory parameters. Field measured parameters include stage and continuous pH measurements at stations SS-01, SS-06G, and SS-07.

Diagnostic samples will be collected using automated samplers (ISCO 3700 and D-TECs) set to collect within the first half hour of a wet weather event. Samplers will be collected if meeting the rainfall criteria of greater than 0.15". Once triggered to sample, ISCO 3700 automated samplers will collect six to eight samples throughout the runoff hydrograph. D-TECs will collect one sample at the beginning of the hydrograph. Locations utilizing ISCOs or D-TECs are listed in Table 6. Samples will be collected within 24 hours of sampling, preserved on ice, and transported to the office for sample preparation. Appropriate preservative (nitric acid for metals) will be added to the sample bottle. Samples will be sent to the lab and analyzed for total and dissolved fraction of multiple metals, inorganic, organic, and general laboratory parameters.

Opportunistic samples will be collected in response to unusual conditions and may be either manually collected or collected with automatic samplers (ISCO 3700). Automatic sampler programming for opportunistic samples will be identical to that employed for wet weather sampling, but the number of samples collected will vary depending on the flow conditions which triggered the sampling. Samples from automatic samplers will be retrieved within 24 hours of sampling, preserved on ice, and transported to the office for sample preparation. Appropriate preservative (nitric acid for metals) will be added to the sample bottle. Samples will be sent to the lab and analyzed for total and dissolved fraction of multiple metals at a minimum.

Step 6: Specify Performance or Acceptance Criteria.

"The purpose of this step is to specify the decision-maker's tolerable limits on decision errors, which are used to establish performance goals for the data collection design."

To mitigate the potential for false positive or false negative errors associated with field sampling, sample collection processes will be consistent with established and relevant SOPs. This includes collection of duplicate samples (and subsequent analysis using Relative Percent Difference (RPD) statistics), implementing a decontamination procedure (when necessary), and the use of field blanks.

Duplicate samples will be collected to determine sampling precision and the correlation between samples. According to the EPA National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA, 2017), a control limit of 20% for water for the RPD shall be used for original and duplicate sample values that are greater than five times the contract required quantitation limit. For laboratory analysis of samples, QA/QC steps (such as the use of laboratory controls, matrix spikes and matrix spike duplicates (MS/MSDs), blanks, etc.) will be consistent with the requirements specified in Section 2.4.2. Additionally, analytical results will undergo 100% data validation and review.

Step 7: Develop the Plan for Obtaining Data.

"The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQOs."

The data collection plan detailed in the following sections is designed to ensure that the data will be of sufficient quality and quantity to assess surface water quality in relation to performance standards. Data from the previous and current investigations will be comparable due to compatible approaches. The monitoring plan described in this QAPP is designed to provide adequate information to meet the objectives described in Section 2.3. The QAPP data collection design (sampling program) is described in detail in Section 3.0 Weather monitoring data will be collected continually at the sites indicated on Figure 3. Ambient meteorological data will include wind direction and speed, temperature, and precipitation.

Normal Flow surface water quality data will be collected monthly at the sites specified in Table 3 and Table 4. Water quality sampling will include both field parameter measurements and laboratory analyses. Field-measured data will include stage, flow, water temperature, specific conductance, dissolved oxygen, and pH. Laboratory measurements will include TDS, TSS, hardness, total recoverable and dissolved metals (Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Molybdenum, Mercury, Silver, and Zinc), dissolved calcium, dissolved magnesium, alkalinity, sulfate, and nitrate/nitrite. TKN, total phosphorus, ammonia, and dissolved organic carbon are measured each month at compliance stations.

Wet weather water quality data will be collected on average, and when wet weather conditions exist, three times per month, during April to October depending on weather conditions. A wet weather event is defined in the Wet Weather Criteria SOP in Appendix B. Samples will be collected using an automatic or mechanical sampler. Laboratory measurements will include TDS, TSS, hardness, total recoverable and dissolved metals (Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Molybdenum, Mercury, Silver, and Zinc), dissolved calcium and magnesium, alkalinity, sulfate, and nitrate/nitrite at all stations, during all sampling events. On the first wet weather event of each month, laboratory analysis will also include TKN, total phosphorus, ammonia, and dissolved organic carbon at compliance stations. Creek stage data will be collected continuously and data downloaded monthly. Continuous creek pH data will be collected at stations SS-01, SS-06G, and SS-07 to ascertain Biotic Ligand Model (BLM) standard parameters.

Sub-drainage wet weather diagnostic water quality sampling data will generally be collected when the creek wet-weather criteria is met; collection will be determined on a case by case basis. On average, and when wet weather conditions exist, three sub-drainage wet weather diagnostic water quality sample sets will be collected per month. Samples will be collected using automatic and mechanical samplers, therefore no field measured data will be collected. Laboratory measurements will include TSS, sulfate, and total recoverable and dissolved trace elements (Arsenic, Cadmium, Copper, Iron, Lead, Mercury, and Zinc). Sub-drainage flow data will be collected continuously and data downloaded monthly.

Opportunistic samples may be collected in response to unusual in-channel conditions such as run-off occurring in the absence of precipitation or discolored water within a channel. Opportunistic samples will be manually collected or collected with automatic samplers. Opportunistic sampling will not include field measured data. At a minimum, opportunistic samples will be analyzed for total recoverable and dissolved trace elements (Arsenic, Cadmium, Copper, Iron, Lead, Mercury, and Zinc).

2.4.2 Measurement Performance Criteria for Data

All data collection will be conducted under CFRSSI or other applicable SOPs to maintain consistent techniques. Sample analysis will be performed by an approved analytical laboratory using methods consistent with the *EPA Contract Laboratory Program Statement of Work ISM02.3* (EPA, 2015) or *EPA Contract Laboratory Program Statement of Work ISMO2.4* (EPA, 2016), and appropriate protocols specified in the *Clark Fork River Superfund Site Investigations Laboratory Analytical Protocol (LAP)*, (ARCO, 1992a).

Measurement performance criteria are established by defining acceptance criteria and quantitative or qualitative goals (e.g., control limits) for accuracy, precision, representativeness, comparability and completeness of measurement data. The definitions of precision, accuracy, representativeness, comparability and completeness are provided below along with the acceptance criteria for data collected. Equations for calculation of precision, accuracy and completeness are provided in Table 7. Information pertaining to the analytical methods that will be employed and the project's target quantitation limits can be found in Section 3.2.

Table 7 - Precision, Accuracy and Completeness Calculation Equations

Characteristic	Formula	Symbols
Precision (as relative percent difference, RPD)	$RPD = \frac{(x_i - x_j)}{\left(\frac{x_i + x_j}{2}\right)} \times 100$	x_i, x_j: replicate values of x
Precision (as relative standard deviation, RSD, otherwise known as coefficient of variation)	$RSD = \frac{\sigma}{\bar{x}} \times 100$	σ: sample standard deviation $\bar{x}$: sample mean
Accuracy (as percent recovery, R, for samples without a background level of the analyte, such as reference materials, laboratory control samples and performance evaluation samples)	$R = \frac{x}{t} \times 100$	x: sample value t: true or assumed value
Accuracy (as percent recovery, R, for samples with a background level of the analyte, such as matrix spikes)	$R = \frac{SSR - SR}{SA} \times 100$	SSR: spiked sample result SR: sample result SA: spike added
Accuracy (as percent difference, D, for samples > 50X the MDL, which have undergone at least a five-fold dilution, with the result, S, corrected for the dilution)	$D = \frac{\lvert I - S \rvert}{I} \times 100$	I: initial sample result S: serial dilution result
Completeness (as a percentage, C)	$C = \frac{n}{N} \times 100$	n: number of valid data points produced N: total number of samples taken

Precision

Precision is the level of agreement among repeated measurements of the same characteristic. There are two general forms of uncertainty. The first is the random error component of the data collection process. The second is inherent stochastic variability, which cannot be eliminated but can be described.

Data precision is assessed by determining the agreement between replicate measurements of the same sample and/or measurements of duplicate samples. The overall random error component of precision is a function of the sampling. The analytical precision is determined by the analysis of field duplicates by laboratories and by replicate analyses of the same sample. An analytical duplicate is the preferred measure of analytical method precision. When analytes are present in samples at concentrations below or near the quantitation limit, precision may be evaluated using duplicate analyses of laboratory prepared samples such as duplicate laboratory matrix spike samples (MS/MSD), duplicate laboratory control spike samples (LCS/LCSD), and/or laboratory duplicate (LD) samples. Precision can be measured as relative percent difference (RPD) or as relative standard deviation (RSD; also known as a coefficient of variation). Formula for both are presented in Table 77.

For this QAPP, precision shall be determined by the analysis of field and laboratory duplicates and the evaluation of the RPD for the paired measurements. The RPD goals for measures of analytical precision are provided in Table .

The RPD precision goal for field and laboratory duplicates will be 20 percent for sample pairs with both sample results being greater than five times the reporting limit (RL). For field and laboratory duplicate pairs with one or both sample results less than five times the RL, a difference of less than or equal to the RL (difference ≤ RL) will be used as the precision goal.

Accuracy/Bias

Accuracy is the degree of difference between the measured or calculated value and the true value. It is a measure of the bias or systematic error of the entire data collection process. Potential sources of systematic errors include:

- sample collection methods;
- physical or chemical instability of the samples;
- interference effects during sample analysis;
- calibration of the measurement system; and
- contamination.

Field blanks and laboratory blanks may be analyzed to assess artifacts introduced during sampling, transport and/or analysis that may affect the accuracy of the data. In addition, ICVs, CCVs, ICBs, and CCBs are used to verify that the sample concentrations are accurately measured by the analytical instrument throughout the analytical run.

Bias in field activities shall be determined by the collection and analysis of field blanks, as described in Section 3.5.1. Field blank accuracy goals include target analyte concentrations less than the method detection limit. Laboratory accuracy will be determined by the analysis of calibration verification samples, calibration blanks, and laboratory control samples. Accuracy/Bias goals for the specific analysis methods are summarized in Table .

Representativeness

Data representativeness is defined as the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point or environmental conditions. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Representativeness of samples shall be achieved through the careful selection of sampling locations and methods. This QAPP has been designed to provide samples that are representative of the medium being sampled as well as a sufficient number of samples to meet the project DQOs, which are described in Section 2.4.1. Sample representativeness may also be evaluated using the RPDs for field duplicate results.

Comparability

Data comparability is defined as the measure of the confidence with which one data set can be compared to another. Comparability is a qualitative parameter but must be considered in the design of the sampling plan and selection of analytical methods, quality control protocols and data reporting requirements. Comparability shall be ensured by analyzing samples obtained in accordance with appropriate SOPs. The results of analyses collected under this QAPP will be compared with previously collected water quality data for the sites in the ground water monitoring plan. All data should be calculated and reported in units consistent with standard reporting procedures so that the results of the analyses can be compared with those of other laboratories, if necessary.

<u>Completeness</u>

Completeness refers to the amount of usable data produced during a sampling and analysis program. The procedures established in this QAPP are designed to ensure, to the extent possible, that data shall be valid and usable. To achieve this objective, every effort shall be made to collect each required sample and to avoid sample loss. The QAPP completeness goal is 95 percent for each matrix.

Table 8 - Summary of Laboratory Quality Assurance/Quality Control Checks (in Table Index)

<u>Sensitivity</u>

Sensitivity refers to the capability to quantify an analyte at a given concentration, and this parameter is associated with the instrument and method detection limits, and the project reporting limits. The desired analytical sensitivity are method detection limits less than the applicable water quality standards specified in Montana Circular DEQ-7, Montana Numeric Water Quality Standards. Table 1 displays the analytical sensitivity.

2.5 Special Training

Field personnel shall be trained in the requirements of this QAPP in a project meeting held prior to the initiation of any field activity. All personnel shall have completed 40-hour HAZWOPER training and kept up with yearly 8-hour HAZWOPER refresher course. All personnel shall also read the QAPP document prior to the start of fieldwork and shall acknowledge that they have read the document at the time of the project meeting. In addition, prior to conducting sampling activities, the Contractor Project Manager, or designee, shall review field procedures and sampling requirements in order to better ensure that samples are collected and handled according to the QAPP requirements.

Field personnel will also be trained in the use of field equipment, decontamination procedures and chain-of-custody procedures in accordance with field data collection SOPs used for the sampling event. This training will be documented within the appropriate section of each SOP. The CPM will be responsible for ensuring that training requirements are fulfilled.

One hard copy of the current approved version of this QAPP shall be maintained for ready reference purposes in the field vehicle or field office. All field team members shall have access to pdf format files of the complete QAPP.

Laboratories providing analytical services will have a documented quality system that complies with EPA *Requirements for Quality Management Plans (QA/R-2) (EPA, 2001b)* and *EPA Contract Laboratory Program Statement of Work ISMO2.4* (EPA, 2016). The Laboratory Quality Manager will be responsible for ensuring that all personnel have been properly trained and are qualified to perform assigned tasks.

2.6 Documents and Records

This section briefly describes the procedures for management of project documentation and records for this QAPP from initial generation of the data to its final use and storage in the project files.

2.6.1 Field Logbooks/Data Sheets

Documentation of observations in the field provides information on conditions at the time of sampling and a permanent record of field activities. Field records will be kept in both a bound field logbook and electronic field forms. The logbook may reference more detailed records found in the electronic field forms. Each logbook shall have a unique document control number, and the logbooks will be bound and have consecutively numbered pages. The information recorded in the logbooks shall be written in indelible ink. Whenever a sample is collected or a measurement is made, the sample site identification and any additional observations will be recorded in the field book. Electronic forms for tasks associated with the QAPP will be developed, and these forms will be available on digital tablets. Each form will have a unique document control number, and once completed, the forms will be checked for accuracy and completeness, and saved. The forms will be uploaded to a main server daily.

Field logbooks and electronic field forms will include the information listed below, at a minimum:

- Date of the field work
- Names and titles of field personnel;
- Meteorological conditions at the beginning of field work and any ensuing changes in the weather conditions;
- A description of the field task;
- Time field work started;
- All field measurements made;
- Any field analysis results; and
- Personnel and equipment decontamination procedures.

In addition to the items listed above, field logbooks will also include

- Name, address and phone number of any field contacts or site visitors (e.g., agency representatives, auditors, etc.);
- Details of the field work performed and the field forms used, with special attention to any deviation from the QAPP or applicable SOPs.

For any water quality sample collection, the following entries will also be made:

- Calibration of any field equipment;
- Identification of field equipment, including make, model, and serial number if available;
- Sample location and ID number;
- Staff gauge reading;
- Date and time of sample collection;
- Sample type collected;
- Sample field preparation;
- Sample preservative;
- Final field parameters (temperature, pH, SC, ORP, DO);
- Split samples taken by other parties (note the type of sample, sample location, time/date, name of person, person's company and any other pertinent information);
- Sampling method, particularly any deviations from the SOPs;
- Documentation or reference of preparation procedures for reagents or supplies that will become an integral part of the sample (if any used in the field).

Changes or deletions in the field logbook will be recorded with a single strike mark through the changed entry, with the sampler's initials and the date recording the new entry. All entries must remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without having to rely on the sampler's memory.

Completed field logbooks will be scanned and stored on a server. No bound field logbooks will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. Completed field data forms will be stored electronically on a main server, using a file structure that separates forms by project and date. No electronic field forms will be deleted, even if they contain inaccuracies that require a replacement document.

2.6.2 Field Photographs

When photographs of field activities are taken, a digital camera will be used. Specifically, photographs should be taken of unexpected circumstances (i.e. a damaged staff gauge). Photographs should include a scale in the picture when practical.

The following items shall be recorded on the electronic field record for each photograph taken:

- The photographer's name, date, time, and the general direction faced;
- A brief description of the subject and the fieldwork portrayed in the picture; and
- Sequential number of the photograph.

The digital files shall be placed in project files with copies of supporting documentation from the bound field logbooks.

2.6.3 Chain of Custody Records

After samples have been collected, they will be maintained under strict chain-of-custody (chain) protocols in accordance with CFRSSI SOP-G-7. The field sampling personnel will complete a chain-of-custody form for each sample shipment (e.g., batch of coolers) delivered to the laboratory for analysis. The sampler is responsible for initiating and filling out the chain-of-custody form. The chain for a sample shipment will list only the samples in that shipment.

Information contained on the chain-of-custody will include the following:

- Project name and identification number;
- Sampler's signature and affiliation;
- Date and time of collection;
- Sample identification number and matrix;
- Analyses requested;
- Preservative used;
- Remarks such as any additional notes to laboratory personnel (e.g., filter in lab or known sample hazards);
- Signature of persons relinquishing custody, dates and times; and
- Signature of persons accepting custody, dates and times.

Any documentation, including chain-of-custody forms, placed inside the cooler during sample shipment should be placed inside a re-closeable plastic bag.

The sampler whose signature appears on the chain is responsible for the custody of the samples from the time of sample collection until custody of the sample is transferred to a designated laboratory, a courier or another project employee for the purpose of transporting the samples to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the responsible individual's physical possession; (2) in the responsible individual's visual range after having taken possession; (3) secured by the responsible individual so that no tampering can occur, (4) secured or locked by the responsible individual in an area in which access is restricted to authorized personnel; or (5) transferred to authorized personnel.

An electronic copy of each transmitted chain-of-custody will be stored on a main server, within project record files (refer to Section 3.9).

2.6.4 Analytical Laboratory Records

Results received from the laboratories will be documented both in report form and in an electronic format. Laboratory documentation includes copies of the signed chain-of-custody forms, laboratory confirmation reports including information on how samples have been batched and the analyses requested, data packages including the lab report and the electronic data deliverable (EDD), and any change requests or corrective action requests. Section 5.1.3 presents the project's laboratory reporting requirements in detail. Electronic report deliverables ("data package" or "report") issued by the laboratories will include data necessary to complete validation of laboratory results in accordance with specifications included in Section 5.2.2.

Original hard copy deliverables and electronic files received from laboratories will be maintained with the project quality records (refer to Section 3.9).

2.6.5 Project Data Reports

A Data Summary Report (DSR) will be prepared based on guidelines in the CFRSSI Pilot Data Report Addendum (ARCO, 2000b) following each year of data collection and evaluation. The DSR will be submitted to the Agencies on an annual basis and will include a summary of all data collected, field measurements, and laboratory analytical results. These data will reside on the BPSOU Document SharePoint Site.

2.6.6 Program Quality Records

Program quality records are defined as completed, legible documents that furnish objective evidence of the quality of items or services, activities affecting quality, or the completeness of data. These records shall be organized and managed by the Remedial Action (RA) entity and shall include, at a minimum:

- This QAPP and any approved revisions or addenda;
- Approved versions of the Health and Safety Plan (HSP) and any addenda;
- Copies of SOPs for field data collection, with any updates, revisions or addenda to those SOPs;
- Incoming and outgoing project correspondence (letters, telephone conversation records, faxes and e-mail messages);
- Electronic field forms;
- Electronic copies of completed sample chain-of-custody forms;
- Copies of all laboratory agreements and amendments;
- As-received laboratory data packages;

- Documentation of field and/or laboratory audit findings and any corrective actions; and
- Draft and final delivered versions of all reports and supporting procedures such as statistical analyses, numerical models, etc.

3.0 MEASUREMENT AND DATA ACQUISITION

The elements in this section address all aspects of project design and implementation for the generation and acquisition of data. Implementation of these elements ensure that appropriate methods for sampling, sample handling, laboratory analysis, field and laboratory QC, instrument/equipment testing, inspection, and maintenance, instrument/equipment calibration, data management and data security are used for all phases of the investigation.

3.1 Sampling Process and Design

This QAPP has been developed to define the requirements for surface water monitoring within the BPSOU. The primary goal of the QAPP is to provide information on the current status of impacted surface waters within the BPSOU. Surface water monitoring performed under this QAPP includes flow measurements, field parameter measurements, and collecting water quality samples for laboratory analysis at the surface water sites specified in Table 3 through Table 45. These tables also specify the monitoring schedule.

3.1.1 Surface Water Monitoring Objectives and Frequency

The objectives of the BPSOU Surface Water monitoring program are:

- Determine if surface water performance standards are being met in-stream.
- Determine the efficacies of implemented BMPs.
- Determine trends in surface water quality.

Measurement of stage and flow will be collected at the frequency specified in Table 3. The monitoring locations are shown in Figure 1 for Creek Monitoring and Figure 2 for Sub-Drainage Diagnostic Monitoring.

Water quality samples will be collected at the frequency specified in Section Data Quality Objectives2.4.1 and the method specified in Table 4. Field parameters measurements and laboratory analysis will occur as indicated in Table 99 for Creek samples, and Table 1010 for Sub-Drainage Diagnostic samples. Figure 1 displays Creek Monitoring locations, while Figure 2 displays locations for Sub-Drainage Diagnostic Monitoring.

Table 9 - Creek Monitoring Parameter List and Associated Analytical Methods, Approximate Method Detection Limits, Reporting Limits, and Holding Times (located in Table Index)

Table 10 - Sub-Drainage Diagnostic Monitoring Parameter List and Associated Analytical Methods, Approximate Method Detection Limits, Reporting Limits, and Hold Times

Analyte	Reporting Limit (µg/L)	MDL (µg/L)	Holding time (days)	Method	Source
Trace Elements – Total Recoverable and Dissolved Fractions (ug/L)					
Arsenic	0.5	0.25	180 Days	200.8 CLP-M	EPA
Cadmium	0.08	0.033	180 Days	200.8 CLP-M	EPA
Copper	1	0.22	180 Days	200.8 CLP-M	EPA
Iron	50	8	180 Days	200.8 CLP-M	EPA
Lead	0.1	0.046	180 Days	200.8 CLP-M	EPA
Mercury	0.01	0.002	28 Days	245.1 CLP-M	EPA
Zinc	5	2.5	180 Days	200.8 CLP-M	EPA
General Laboratory (mg/L)					
Sulfate	2.5	1.2	28 Days	ASTM D516	EPA
TSS	10	dwi	7 Days	SM 2540D	EPA

Should a monitoring site become inaccessible on a temporary basis, if possible the monitoring schedule will be revised to provide accessibility to that site. Should a monitoring site become permanently inaccessible, the need for the site will be evaluated. If it is determined that the monitoring objectives can be achieved without the inaccessible site, with Agency approval, the site will be removed from the monitoring network. Should the site be deemed necessary, actions to repair the site will be implemented or an alternate site will be proposed.

Critical data includes stage, measured flow rate, and laboratory analytical data. Field parameters (DO, pH, SC, and temperature) are informational data. Stage-discharge curves cannot be developed without first obtaining flow measurements at a range of creek levels, or stages. Flow measurements (or flows determined from stage-discharge curves) and analytical data are critical for calculating COC loads. Analytical data is critical for comparing measured COC concentrations to performance criteria.

Variability in surface water quality and flow data is expected considering the range of monitoring conditions which may occur. However, normal flow COC concentrations should remain within recent historical ranges. Wet weather flow COC concentrations are far more likely to have outliers, but extreme outliers will be investigated. To limit variability due to stage readings, flow measurements, sampling, and analysis, consistent methods will be used in accordance with applicable SOPs. Field documentation will occur during surface water monitoring, and should significant variability be found in stage, flow, or water quality results, this documentation will be consulted. In addition, unexpected analytical results will be verified by contacting the laboratory and requesting a data review, and by validating 100% of analytical data to ensure that laboratory QC criteria were met.

3.2 Sampling Methods

3.2.1 Applicable Standard Operating Procedures (SOPs)

A list of the SOPs used for the site investigation are listed below in Table 51 and included in Appendix B. SOPs may be updated as needed, upon approval from agencies.

Table 51 - Project Sampling SOP References

Reference Number	Title, Revision Date	Originating Organization
G-4	Field Logbook/Photographs	ARCO
G-5	Sample Packaging and Shipping	ARCO
G-6	Field Quality Control Samples	ARCO
G-7	Sample Custody	ARCO
SOP-H-01	Water Sampling Equipment Decontamination	TREC, Inc.
SOP-H-02	Downloading Transducers with Levellogger	TREC, Inc.
SOP-H-03	Download Weather Station	TREC, Inc.
SOP-H-05	Calibrate YSI Professional Plus Multi-Meter	TREC, Inc.
SOP-S-01	Bump Testing the VENTIS MX4 Gas Meter	TREC, Inc.
SOP-SW-01	Surface Water Sampling	TREC, Inc.
SOP-SW-02	Flow Measurements in Wadeable Streams	TREC, Inc.
SOP-SW-03	Change H350 Stage Recorder Data Card	TREC, Inc.
SOP-SW-04	Download ISCO Stage Recorder	TREC, Inc.
SOP-SW-05	Download Sutron Stage Recorder	TREC, Inc.
SOP-SW-06	Read Staff Gauge	TREC, Inc.
SOP-SW-07	Change ISCO Batteries	TREC, Inc.
SOP-SW-08	Automatic and Mechanical Sampler Setup	TREC, Inc.
SOP-SW-09	Collect Sample from DTEC Sampler	TREC, Inc.
SOP-SW-10	Collect Sample from ISCO Sampler	TREC, Inc.
SOP-SW-11	D-TEC Sample Preparation	TREC, Inc.
SOP-SW-12	Surface Water Wet Weather Sample Preparation	TREC, Inc.
SOP-SW-13	Change ISCO Batteries on Samplers Located in Manholes	TREC, Inc.
SOP-SW-14	Collect Sample from ISCO Sampler in Manhole	TREC, Inc.
SOP-SW-16	Signature Bubbler Setup	TREC, Inc.

Reference Number	Title, Revision Date	Originating Organization
SOP-SW-017	Construction of TTEC Sampler	TREC, Inc.
SOP-SW-18	Calibrate TieNet 301 pH Sensor (Signature Bubbler)	TREC, Inc.
SOP-SW-20	Wet Weather Trigger Criteria	TREC, Inc.

3.2.2 Data Collection Method

3.2.2.1 Weather Measurements

Weather monitoring will occur throughout the monitoring period, including during wet weather events, so that relationships between rainfall and runoff can continue to be evaluated. Figure 3 identifies the sites for which weather measurements will be made. Precipitation is currently being monitored at HKMR3, CB-1, Kelley Mine, Blacktail Canyon, BMMA, BSB Shop, BTL/LAO, and Basin Creek SNOTEL site. The frequency of measurements varies by station. BMMA and Basin Creek stations report daily data; while stations HKMR3, CB-1, Blacktail Canyon, and BSB Shop report hourly data. Kelley Mine and BTL/LAO data are reported every 6 minutes. Weather stations Kelley Mine, CB-1 and BSB Shop are maintained by TREC and will make measurements with a Davis Instruments Vantage Pro2, which measures wind direction and speed, precipitation, and temperature, along with several other meteorological parameters. The Kelley Mine and BTL/LAO weather stations upload data to Weather Underground, thus has infinite storage capacity. Storage capacity for the CB-1 and BSB Shop weather stations is approximately 45 days at a 30-minute recording rate. Weather stations other than Kelley Mine, CB-1, and BSB Shop are maintained by other entities and use various equipment to report weather parameters.

3.2.2.2 Flow Measurements

Surface water flow measurements will be performed according to the applicable TREC and CFRSSI SOPs (ARCO 1992d) for surface water flow measurements. Surface water flow measurements are to be conducted with equipment consistent with CFRSSI SOPs (ARCO 1992d), unless updated equipment is available, in which case that equipment can be used with appropriate SOPs. Table 3 identifies the sites for which surface water flow measurements will be made, along with the frequency for normal flow and wet weather monitoring. Table 62 identifies the precision for each type of flow monitoring equipment. Equipment listed in Table 6 will be maintained in accordance with manufacturer's instructions. Much of the equipment in Table 62 is permanently deployed at dedicated sites and is in contact only with the water body in which it is deployed. Thus, cross-contamination or contamination from outside sources is not applicable. However, the equipment will be inspected on a regular basis, and fouling agents removed if necessary. At several sites, ISCO equipment is removed during winter months; and prior to re-deployment, that equipment will be thoroughly cleaned.

Table 62 - Flow Measurement Equipment Specifications

Parameter	Equipment	Unit	Resolution
Manual Flow	Flo Mate 2000	ft/s	0.01 ft/s
Continual Flow	ISCO 2150 A-V meter	cfs	0.01 cfs
Continual Stage	ISCO 4230 Flow Meter	feet	0.01 ft
Continual Stage	Water Log H350/355 Bubbler System	Feet	0.01 ft
Continual Stage	Solinst Edge Pressure Transducer	Feet	0.01 ft
Continual Stage	Sutron 9210 XLITE	Feet	0.01 ft

Creek Normal Flow Conditions

Staff gauges will be read to an accuracy of 0.01 feet before and after flow measurements are taken. Staff gauges are installed and secured with a cement foundation or other method to prevent movement during higher flows. Manual flow measurements will be made with a Marsh McBirney Flo Mate 2000, or comparable portable flow meter, and will be collected according to SOP-SW-02. Continual water depth measurements will be made with continuous stage recorders such as ISCO Signature, ISCO 4230, Water Log H350, and Sutron 9210 X-Lite bubbler systems, and Solinst Edge pressure transducers. Continual stage monitoring equipment will be set to collect a data point every 15 minutes. Water Log, Sutron, and Solinst equipment are set in linear mode, while ISCO equipment is set in roll-over mode. The minimum storage capacity for these devices is 75 days; thus, with a monthly download schedule, data loss should not occur. Table 3 shows the flow measurement method to be used for each site. Table 62 identifies the precision for each type of flow monitoring equipment.

Creek Wet Weather Conditions

Continuous stage recorders, in combination with stage-discharge curves developed from manual flow measurements, will be used to for continuous flow monitoring at Creek sites. Continuous stage recorders will be downloaded with a laptop computer, an electronic, or a hand-held field device specific to the recorder type with appropriate communication cables. Stage-discharge curves are developed according to USGS protocol (Sauer 2002). Stations SS-04 and SS-07 continuous flows are monitored by USGS. Table 3 shows the flow measurement method to be used for each site. Table 62 identifies the precision for each type of flow monitoring equipment.

Sub-Drainage Wet Weather Conditions (Diagnostic Monitoring)

For diagnostic continuous flow measurements, ISCO 2150 area-velocity (A-V) meters will be used. A-V meters record water velocity and flow depth, then calculate (and store if programmed to do so) flow, based on these parameters. This method will be applied to storm drain pipes culverts, and/or weirs installed in channels. A-V meters are set to record at 15-minute intervals. Select A-V meters will increase the recording rate to 5-minute intervals when increased flow is detected. A-V meters will be downloaded with a laptop computer, an electronic tablet, or a hand-held field device specific to the recorder type, with appropriate communication cables. Table 3 shows the flow measurement method to be used for each site. Table 62 identifies the precision for each type of flow monitoring equipment.

3.2.2.3 Surface Water Sample Collection

Surface water sampling and sample handling, preservation, custody, and other associated activities will be performed per the applicable TREC and CFRSSI SOPs (ARCO 1992d) for surface water sampling and sample water filtration. Surface water sampling is to be conducted with equipment consistent with CFRSSI SOPs (ARCO 1992d), unless updated equipment has been made available, in which case updated equipment can be used. Table 4 identifies the sites for which surface water samples will be collected along with the frequency. Table 4 also identifies the type of sampling equipment used at each wet weather and diagnostic location. Water quality samples will be taken in accordance with SOP-SW-01 for normal flow, and SOP-SW-09, SOP-SW-10, SOP-SW-11, and SOP-SW-12 for wet weather flow. Table 73 provides a bottle count and preservative used for each sample. Table 99 provides a list of analytical parameters for creek normal flow sampling events and creek wet weather sampling. Table 1010 provides the list of analytical parameters for sub-drainage wet weather diagnostic events.

Table 73 – Creek Monitoring Analytical Bottle Count and Preservative Addition (Located in Table Index)

Unexpected problems relating to data collection may include samples being spilled and equipment failures. In the event of a sample spill in the field, the surface water site will be re-sampled. Since surface water sampling is synoptic and associated with specific flow conditions, re-sampling a single site at a later date is not judicious. Thus, the chance of spills in route to the lab will be minimized by packing coolers in a manner which eliminates void spaces and retains sample bottles in an upright position. Field team members will be responsible for resampling surface water sites when sample spills occur in the field. The Field Team Leader will be informed of sample spills which occur during storage or shipment and will document such spills in the project records (field logbook, electronic forms).

Creek Normal Flow Conditions

Samples will be collected as per SOP-SW-01. Samples will be collected using equal width increment (EWI) sampling techniques; and at areas where the stream is not well mixed, a churn splitter will be used to adequately mix stream water. To minimize impacts from sediment mobilization, sites will first be sampled for water quality and flow measurements will follow. Samples to be analyzed for dissolved metals and dissolved organic carbon will be field filtered through 0.45-micron disposable filters into clean laboratory bottles. Appropriate preservative (nitric acid for metals, sulfuric acid for DOC, NO_2/NO_3, NH_3, TKN, and Phosphorus) will be added to the sample bottle. Samples will be sent to the lab and analyzed for the parameters indicated in Table 99.

Field parameters will be measured using a hand-held field meter(s) which measures dissolved oxygen (DO), pH, specific conductivity (SC), and temperature. Measurement units and precision are specified in Table 99.

Creek Wet Weather Conditions

Samples will be collected using automated samplers (ISCO 3700 and D-TECs) set to collect within the first half hour of a wet weather event as described in Section 2.4.1. Once triggered to sample, ISCO 3700 automated samplers will collect four samples hourly throughout the runoff hydrograph. D-TECs will collect one sample at the beginning of the runoff hydrograph and will be submitted for analysis in the event of an

ISCO failure. Samples will be retrieved within 24 hours of sampling, preserved on ice, and transported to the office for sample preparation. Samples to be analyzed for dissolved metals and DOC will be filtered through 0.45-micron disposable filters into clean laboratory HDPE bottles. Appropriate preservative (nitric acid for metals, sulfuric acid for DOC, NO_2/NO_3, NH_3, TKN, and Phosphorus) will be added to the sample bottle. Samples will be sent to the lab and analyzed for the parameters described in Table 9. Continuous pH measurements will be made with ISCO Signature Flow Meters at 15-minute intervals at stations SS-01, SS-06G, and SS-07. Measurement units and precision are specified in Table 99.

Sub-Drainage Wet Weather Conditions (Diagnostic Monitoring)

Samples will be collected using automated samplers (ISCO 3700 and D-TECs) set to collect within the first half hour of a wet weather event as defined in Section 2.4.1. Samplers will be set to trigger/collect at a stage as low as practical but will only be collected if meeting the rainfall criteria of greater than 0.15", and the frequency criteria of up to three samples per month. Once triggered to sample, ISCO 3700 automated samplers will collect six to eight samples, with completion of the programming routine, throughout the runoff hydrograph. D-TECs will collect one sample at the beginning of the hydrograph. Locations utilizing ISCOs or D-TECs are listed in Table 4. Samples will be collected within 24 hours of sampling, preserved on ice, and transported to the office for sample preparation. Samples to be analyzed for dissolved metals and DOC will be filtered through 0.45-micron disposable filters into clean laboratory bottles. Appropriate preservative (nitric acid for metals) will be added to the sample bottle. Samples will be sent to the lab and analyzed for the parameters described in Table 10.

BSB will perform occasional Operations and Maintenance (O&M) activities on the Missoula Gulch catch basins that may result in a discharge from CB-9. TREC will be informed by BSB of O&M activates prior to start. If discharge from CB-9 occurs and water flows through channel to SBC during the wet weather season, a sample will be collected by the automated sampler at MG-CLV-0 and will be labeled as such. If discharge from CB-9 occurs and water flows through channel to SBC outside of wet weather season, when automated samplers are not deployed, an opportunistic field grab sample will be collected as per SOP-SW-01 using equal width increment sampling techniques if flow width deems it necessary. Samples will be prepped and preserved as stated above and sent to the lab to be analyzed for parameters described in Table 100.

ISCO 3700 samplers as well as D-TEC samplers will be deployed in-situ during wet weather season. When automatic samplers (ISCO 3700 or D-TEC) collect, polypropylene sample bottles are filled. Prior to re-use, these bottles will be thoroughly decontaminated. When deployed, ISCO 3700 samplers include intake tubing and an intake screen. New tubing will be used at the beginning of each sampling season, and the intake screen will be thoroughly cleaned at the beginning of each sampling season. The tubing and screen will be periodically checked for damage or fouling throughout the wet weather season and cleaned or replaced as necessary. Continual pH measurements will be monitoring at select sites by utilizing an in-situ pH probe with ISCO Signature flow meters. Similar to the checks on sampler tubing and intake screens, pH probes will be periodically checked for fouling or damage and cleaned or replaced as necessary.

3.2.3 Sampling Equipment

The complete field equipment needs for surface water sampling are:

- Hard copy of the QAPP;
- Electronic field tablet, which is loaded with appropriate sampling forms;

- Bound and numbered field notebook;
- Padlock keys;
- Churn Splitter;
- Multi-meter, or individual DO, ORP, pH, SC, and temperature meters;
- Peristaltic pump;
- Appropriate tubing;
- Long and short impervious gloves
- Sample bottles (HDPE);
- 0.45-micron disposable filters;
- Decontamination water, decontamination solutions, decontamination vessel;
- Sample labels and waterproof marker;
- Sample coolers and ice;
- Required Level D Personal Protective Equipment (PPE) including: hard hat, safety glasses with side shields, high visibility vest (or shirt), long-sleeved shirt,

Unexpected problems relating to data collection may include samples being spilled and equipment failures. In the event of a sample spill, either in the field or in route to the laboratory, the surface water site will be re-sampled. To minimize the chance of spills during shipping, coolers will be packed in a manner which eliminates void spaces. Equipment failures may occur with sampling pumps, batteries, field meters, flow meters, laptop computers, communication cables, or manufacturer specific download devices. Spare pumps, batteries, flow meters, laptop computers, and communication cables will be kept on hand. Two field meters will be available, and spare probes will be kept on hand for the meters. However, there may be meter failures which require factory repair, in which case a rental meter will be obtained. Continuous stage recorders are downloaded with a laptop computer.

The Field Team Leader will be responsible for maintaining an inventory of spare equipment, as well as ordering replacement or rental equipment. Field team members will be responsible for resampling surface water sites when sample spills occur in the field. The Field Team Leader will be informed of sample spills which occur during storage or shipment and will assign team members to resample the associated surface water site.

3.3 Sample Handling and Custody

3.3.1 Sample Holding Time

Table 99 and Table 10 detail maximum holding times between sample collection and sample laboratory analysis. In regard to continuous water level monitoring, data will be downloaded from recording devices on a monthly schedule. Continuous water level monitors at BPSOU sites are set to record data on 15-minute intervals. Since continuous water level monitors deployed at BPSOU sites are capable of storing at least 75 days of data, there is adequate storage capacity for a monthly download schedule.

3.3.2 Sample Handling and Storage

After collection and labeling, the surface water samples will be placed in coolers and kept between 0 and 6°C. The samples will be maintained under strict chain-of-custody protocols. The field sampling personnel will complete a chain-of-custody form for each laboratory delivery/shipment. The chain-of-custody form(s) will be placed in a re-sealable plastic bag and placed in the cooler with the samples. Samples will be delivered/shipped within two weeks of sample collection, in accordance with CFRSSI SOP G-5. Analyses for alkalinity, TDS, and TSS require a holding time of less than two weeks, so samples will be shipped as soon as possible after collection and preservation to ensure holding time are met. Samples will be placed in coolers, along with a sufficient volume of double-bagged ice to maintain a sample temperature of 0 to 6°C up until the time of sample receipt by the laboratory. Should void spaces exist in the coolers, these spaces will be filled with non-contaminating packing material to prevent samples from shifting, and possibly spilling, during shipment. Coolers which are to be shipped will be custody sealed, securely taped shut, and have a shipping label securely adhered to the cooler. Sample containers hand delivered to the laboratory do not need to be prepared for shipping, but sample temperature must be maintained between 0 and 6 °C.

The sampler is responsible for initiating and filling out the chain-of-custody. Each sample in the shipment will be listed on the chain-of-custody, and the chain will contain the project code, the project name, sample IDs, sample dates, samples times, analyses requested, preservative used for each sample analysis, any remarks, name and signature of person relinquishing samples, date and time samples were relinquished, name and signature of sample recipient, date and time samples were received, and the tracking number for any sample container which will be shipped.

The sampling personnel whose signature appears on the chain-of-custody is responsible for the custody of the samples from the time of sample collection until custody of the samples is transferred to a designated laboratory, a courier, or to another project employee for the purpose of transporting the sample to the designated laboratory. Custody is transferred when both parties to the transfer complete the portion of the chain-of-custody under "Relinquished by" and "Received by". Signatures, printed names, company names, dates and times are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy) or photocopy of the chain-of-custody. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the chain-of-custody. Copies, receipts and carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is not necessary for courier personnel to sign the chain-of-custody as long as custody seal(s) remain intact until receipt by the intended entity

Upon receipt by the laboratory, the samples will be inspected for sample integrity. The chain-of-custody will be immediately signed, dated and reviewed by laboratory personnel to verify completeness. Any discrepancies between the chain-of-custody and sample labels and any problems or questions noted upon sample receipt will be communicated immediately to the Field Team Leader. The laboratory shall provide the Field Team Leader and Contractor Quality Assurance Officer with a copy of the chain-of-custody and associated sample-receipt information within two working days of receipt of samples. The sample-receipt information routinely provided will include sample receipt date, sample IDs transcribed from the chain-of-custodies, sample matrix type and list of analyses to be performed for each sample. Broken custody seals, damaged sample containers, sample labeling discrepancies between container labels and the chain-of-custody form, and analytical request discrepancies shall be noted on the chain-of-custody form. The Field Team Leader and Contractor Quality Assurance Officer shall be notified of any such problems; and discrepancies or non-conformances shall be resolved and addressed before the samples are analyzed.

The laboratory will be responsible for following their internal custody procedures from the time of sample receipt until sample disposal. Samples and extracts shall be stored in a secure area controlled by the laboratory's designated sample custodian. Samples shall be removed from the shipping container and stored in their original containers unless damaged. Damaged samples shall be disposed of in an appropriate manner after notifying the Field Team Leader and Contractor Quality Assurance Officer, and authorization to dispose is received and documented. In addition, samples shall be stored after completion of analyses in accordance with contractual requirements.

3.3.3 Field Documentation

All field entries will be recorded in a bound logbook and on electronic field forms. Logbook entries and the electronic form will be completed prior to proceeding to the next sample location. All field logbook and electronic form entries will be consistent with CFRSSI SOP G-4. Specific entries will include but are not necessarily limited to the following: sample location; sample date and time; staff gauge reading; sample identification number; sample analysis, sample field preparation, sample preservative, final field parameters, sampling equipment decontamination, weather conditions, personnel present and associated organization, and any deviations from the QAPP protocol.

3.3.4 Sample Identification and Labeling

All surface water samples collected will have a unique sample ID that follows an alpha-numeric code. A label will be placed on each sample bottle, and every label will contain the following information: sample ID, sample date, sample time, requested analysis, preservative added, field preparation method (i.e. filtered), and samplers' initials. The same information will be recorded on the field form, along with the sample site. The sample ID on the bottle will exactly match the sample ID on the field form and on the chain-of-custody (see Section 2.6.3).

The field sample identification scheme consists of letters to identify the sample type, followed by a 4-digit number to identify sample number. The sample number is followed by 6 digits representing the monitoring date. The following are examples of sample identification codes:

Sample Code:		SWWW0073-050118
SW	=	Surface Water Sample
WW	=	Wet Weather Sample (BF=Normal Flow) (SD=Storm Drain) (OM=Operations and Maintenance sample)
0073	=	Sample number of 73
050117	=	Monitoring date of 5/1/2017

3.3.5 Sample Chain of Custody

The sampler is responsible for initiating and filling out the chain-of-custody. Each sample in the shipment will be listed on the chain-of-custody, and the chain will contain the project code, the project name, sample IDs, sample dates, samples times, analyses requested, preservative used for each sample analysis, any remarks, name and signature of person relinquishing samples, date and time samples were relinquished, name and signature of sample recipient, date and time samples were received, and the tracking number for any sample container shipment. An example chain of custody can be found in Appendix C.

3.4 Laboratory Methods

Samples will be analyzed using methods consistent with the CFRSSOU LAP, (ARCO, 1992a), American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater, and

EPA SW846 protocols will be followed. The analytical method and detection limit requirements will be updated as required by the governing regulatory agency.

3.4.1 Sample Preparation Methods

Surface water samples will be prepared for analysis as the EPA approved methods dictate.

3.4.2 Sample Analysis Methods

Surface water samples will be analyzed in accordance with the appropriate EPA methods. A summary of sample analyses and methods is provided for Creek monitoring in Table 99 and for Sub-drainage diagnostic monitoring in Table 1010, which can be found in Section 2.4.1. Table 99 and Table 1010 include current detection and reporting limits, but these are determined on an annual basis; thus, they will fluctuate and will be updated in the annual revisions to this QAPP as necessary.

3.4.3 Laboratory Equipment

Required laboratory equipment is an inductively coupled plasma mass spectrometer for metals/metalloids analysis, and a cold vapor atomic absorption spectrophotometer for mercury analysis. Additional analytical equipment requirements are an auto titrator, a discrete analyzer, and ovens and analytical scales.

3.4.4 Sample Disposal

Disposable equipment and all other solid waste associated with sample collection will be immediately placed in trash bags in order to avoid cross-contamination and to maintain an orderly work environment. The bagged trash will be disposed of at a waste disposal facility. Samples which are shipped to the laboratory will be archived for six months, and after that time the laboratory is responsible for sample disposal.

3.5 Quality Control

Sample QC protocols will be consistent with CFRSSI SOP G-6 and will include 1 field duplicate for every 20 primary samples and, if sampling equipment is reused across sample locations, 1 field blank collected for every 20 primary samples. Any deviation from the CFRSSI or other SOPs, or this QAPP, will be identified in the logbook and discussed in a data summary report, or similar, if required.

3.5.1 Field Quality Control Samples

Field quality control samples are introduced into the measurement process to provide information on transport, storage and field handling biases, and field sampling precision. The QC samples that follow will be collected for analysis identical to that which is required on primary samples. Brief descriptions of the QC samples to be utilized during ground water sampling are provided below, along with instructions for their frequencies of collection and analyses.

Field Duplicate

A field duplicate is a second sample collected from the same location in immediate succession to the primary sample, using identical techniques. The duplicate sample will have its own unique sample identification number, but will be sealed, handled, shipped, and analyzed in the same manner as the primary sample. Analysis will be identical for the primary and duplicate sample. The analytical results of the duplicate sample will be compared to determine sampling precision. Field duplicate samples will be collected at a frequency of one per 20 samples or once per sampling event.

Field Blank

Field Blanks will be used to help identify possible contamination from the sampling environment, from sampling equipment, or from sample handling. A Field Blank (FB) is a sample of deionized water and appropriate preservatives prepared in the field. The FB is contained in a sample bottle randomly chosen from each lot of bottles received from the supplier. Field blanks will be collected by pouring ASTM Type II DI water into a single-use plastic container and triple rinsing. The container will then be filled with ASTM Type II DI water, from which the FB will be collected. The FB sample will be given its own sample identification, but will be sealed, handled, shipped, and analyzed in the same manner as the primary sample. Analysis will be identical to the primary samples. Field Blanks will be prepared once for every 20 samples collected, or once per sampling event, whichever is more frequent.

3.5.2 Laboratory Quality Control Samples

Laboratory QC samples are introduced into the measurement process to evaluate laboratory performance and sample measurement bias. Control samples may be prepared from environmental samples or generated from standard materials in the laboratory. The appropriate type and frequency of laboratory QC samples are described in the associated method. Examples of typical laboratory QC Samples are listed in Table 8 but are not limited to this list.

Method Blank

Method blanks should be prepared and analyzed for every 20 samples analyzed. The method blank is laboratory DI water which has gone through the applicable sample preparation and analysis procedure. Control limits are generally a concentration < ½ RL, but there are exceptions. The complete control limits and corrective actions for control limit failures are outlined in Table .

Laboratory Control Sample

A laboratory control sample (LCS) consists of a laboratory blank sample with a known concentration of the target analyte. The LCS sample is prepared and analyzed in the same manner as field samples. Percent recovery of the target analytes in the LCS helps determine whether the laboratory's methodology accurate and precise. One LCS should be analyzed for every 20 samples analyzed. As Table shows, control limits vary depending on the analysis. If the LCS fails to meet the specified control limit, the analysis must be terminated, the problem corrected, and samples which fell in the failed LCS batch must be re-analyzed.

Laboratory Duplicates

Laboratory duplicate (LD) samples test laboratory precision, and one LD sample should be analyzed for every 20 samples. Samples which are known to be field blanks cannot be used for LD samples. Control limits vary depending on the analysis, and these are summarized in Table . The relative percent differences (RPD) between the sample and duplicate that are specified in Table are applicable if both the sample and duplicate are ≥ five times the RL. If either the sample or duplicate is < five times the RL, the control limit is an absolute difference between the sample and duplicate no greater than the RL. Should LD samples fail to meet control limits, and the samples in the associated batch are of a similar matrix, then associated sample results should be flagged. If samples in the associated batch are not similar to the parent sample used for the LD, then only the parent sample used to prepare the duplicate should be flagged.

A laboratory control spike duplicate (LCSD) is a duplicate of the LCS. The LCSD tests laboratory reproducibility. As Table indicates, LCSD samples are not required for all analyses, and criteria vary depending on the method. In the event of a LCSD failure, the analysis should be terminated, the problem corrected, and samples reanalyzed; or analysis can proceed based on other criteria.

A matrix spike duplicate (MSD) is a duplicate of the MS. The MSD is used to determine analytical precision and bias of a method in a sample matrix. As Table indicates, MSD samples are not required for all analyses, and criteria vary depending on the method. In the event of an MSD failure, the parent sample and associated batch will be flagged. If associated batch is not similar in analyte concentration to parent sample, only parent sample shall be flagged.

Matrix Spike

Matrix spike (MS) samples evaluate the effect of the sample matrix on sample preparation and measurement methodology. One MS must be analyzed for each group of 20 samples. The control limit for MS samples is 70-130% recovery for samples that are < four times the spike added. If the parent sample concentration is > four times the spike added, this criterion is waived. Samples which are known to be field blanks cannot be used for MS samples. Corrective action varies, depending on the MS percent recovery, and these are detailed in Table .

3.6 Instrument/Equipment Testing, Inspection and Maintenance

In order to ensure continual quality performance of any instruments or equipment, testing, inspection and maintenance shall be performed and recorded as described in this section.

3.6.1 Field Equipment

Field equipment will be examined to certify that it is in proper operating order prior to its first use. Equipment, instruments, tools, gauges and other items requiring preventative maintenance will be serviced in accordance with the manufacturer's specified recommendations. Field equipment will be cleaned and safely stored between each use. Any routine maintenance recommended by the equipment manufacturer will also be performed and documented in field logbooks or appropriate data sheets. Equipment will be inspected and the calibration checked, if applicable, before it is transported to a field setting for use. Personnel responsible for field equipment examination, cleaning, maintenance, and storage include the field team leader, the QAO, and field team personnel.

3.6.2 Laboratory Equipment

Instruments used by the laboratories will be maintained in accordance with each laboratory's Quality Assurance Plan and analytical method requirements. All analytical measurement instruments and equipment used by the laboratory shall be controlled by a formal calibration and preventive maintenance program.

The laboratories will keep maintenance records and make them available for review, if requested, during laboratory audits. Laboratory preventive maintenance will include routine equipment inspection and calibration at the beginning of each day or each analytical batch, per the laboratory's internal SOPs and method requirements. Laboratory personnel are responsible for laboratory equipment examination, cleaning, maintenance, and storage.

3.7 Instrument/Equipment Calibrations and Frequency

Field multi-meters will be calibrated, prior to use as necessary. Meters will be calibrated following manufacturer's instructions, and using manufacturer recommended calibration solutions. Calibration logs will be stored electronically, within project files. Calibration failures will result in meters being immediately removed from service. Once repaired, and successfully calibrated, meters will be returned to service. Calibration of the YSI Pro-Plus Multi-Meter will be done in accordance with SOP-H-05. Calibration of the ISCO 3700 will done in accordance with SOP-SW-18.

3.8 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables received for the project (e.g., sampling equipment, calibration standards, etc.) will be checked for damage and other deficiencies that would affect their performance. The types of equipment that will be needed to complete sampling activities are described in the relevant SOPs. Inspections of field supplies will be performed by the Field Team Leader or Field Team Members.

The personnel at each laboratory will be responsible for performing inspections of laboratory supplies in accordance with their QA program.

3.9 Data Management Procedures

This section describes the management of data for the project including field and laboratory data. The program quality records will be maintained by Atlantic Richfield. These records, either electronic or hard copy in form, may include:

- Project work plans with any approved modifications, updates, and addenda;
- Project QAPP, including this QAPP, with any approved modifications, updates, addenda, and any approved corrective or preventative actions;
- Field documentation;
- Chain-of-custody records;
- Laboratory documentation (results received from the laboratory will be documented both in report form and in an electronic format); and
- Data Summary Reports.

Data will be checked, stored, and used in accordance with the BPSOU data management plan (DMP). Data collected during this project will be used to evaluate and support decision making for RD/RA and monitoring and maintenance. Currently geospatial data is stored in a Geodatabase, non-geospatial data is stored in Microsoft (MS) Structured Query Language (SQL) databases or MS Access databases that can be accessed by an on-line portal. The long-term objective of the DMP (Atlantic Richfield 2017) is to create a centralized database system, maintained by both AR and BSB, enabling all users to manage and use spatial and non-spatial information consistently, effectively, and efficiently.

Hard-copy field and laboratory records shall be maintained in the project's central data file, where original field and laboratory documents are filed chronologically for future reference. These records are also scanned to produce electronic copies. These electronic copies, along with all electronic field and laboratory records, are maintained on a central server system with backup scheduled on a daily basis. The QAO is responsible for uploading and management of the database.

Before field and laboratory data are incorporated into the project database, the data and supporting documentation shall be subject to appropriate review to ensure the accuracy and completeness of original data records. Field data that has been reviewed in a hard-copy format will be entered into electronic data files for upload to the project database. All manual data entry into an electronic format will be reviewed by a separate party before such data are incorporated into the database. Laboratory EDDs and related data packages will be reviewed as part of the internal data review process. Following these review steps, field and laboratory electronic data files will be imported to the project database.

Standardized data import formats and procedures will be used to upload both field and laboratory data into the electronic database. Standardized parameter names, numerical formats and units of measure may be applied to the original information to facilitate comparability across all datasets and within the database.

4.0 ASSESSMENT AND OVERSIGHT

Assessment and oversight of data collection and reporting activities are designed to verify that sampling and analyses are performed in accordance with the procedures established in this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits. Internal audits will be performed by the QAO and/or QAM as necessary. External audits will be performed by the EPA as necessary.

Performance and systems audits of field and laboratory data collection and reporting procedures are described in this section.

4.1 Corrective Actions

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out-of-QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, and data assessment.

Nonconforming equipment, items, activities, conditions and unusual incidents that could affect data quality and attainment of the project's quality objectives will be identified, controlled and reported in a timely manner. For the purpose of this QAPP, a nonconformance is defined as a malfunction, failure, deficiency or deviation that renders the quality of an item unacceptable or indeterminate in meeting the project's quality objectives.

Corrective action in the laboratory may occur prior to, during and after initial analyses and will be reported to the AROPM and QAO. Conditions such as broken sample containers, preservation or holding-time issues and potentially high-concentration samples may be identified during sample log-in or prior to analysis. Corrective actions to address these conditions will be taken in consultation with the AROPM and QAO and reported on a Corrective Action Report, which is included in Appendix C. In the event that corrective action requests are not in complete accordance with approved project planning documents, the AROPM will consult with EPA, and concurrence will be obtained before the change is implemented.

If during analyses of the samples, the associated laboratory QC results fall outside of the project's performance criteria, the laboratory should initiate corrective actions immediately. Table indicates the performance criteria for specific analytical methods and the appropriate corrective actions to be completed if QC results are outside of the project specifications. Following consultation with lab analysts and section leaders, it may be necessary for the Laboratory Quality Manager to approve the implementation of a corrective action. These conditions may include dilution of samples, additional sample extract cleanup, automatic re-analysis when certain QC criteria are not met, etc. If the laboratory cannot correct the situation that caused the nonconformance and an out-of-control situation continues to occur, or is expected to occur, then the laboratory will immediately contact the QAO and request instructions regarding how to proceed with sample analyses.

Completion of any corrective action should be evidenced by data once again falling within the project's performance criteria. If this is not the case, and an error in laboratory procedures or sample collection and handling procedures cannot be found, the results will be reviewed by the AROPM with input from others to assess whether re-analysis or re-sampling is required.

All corrective actions taken by the laboratory will be documented in writing by the Laboratory Project Manager and reported to the CPM and QAO. In the event that corrective action requests are not in complete accordance with approved project planning documents, EPA will be consulted, and concurrence will be obtained before the change is implemented. All corrective action records will be included in the program's quality records.

4.2 Corrective Action during Data Assessment

The QAO may identify the need for corrective action during data assessment. Potential types of corrective action may include re-sampling by the field team, re-analysis of samples by the laboratory or re-submission of data packages with corrected clerical errors. The appropriate and feasible corrective actions are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded, etc.). In the event that corrective action requests are not in complete accordance with approved project planning documents, the EPA will be consulted by the AROPM and QAM and concurrence will be obtained before the change is implemented. Corrective actions of this type will be documented by the QAO on a CAR and will be included in any subsequent reports.

4.3 Quality Assurance Reports to Management

After the investigation is complete, Atlantic Richfield will prepare a Data Summary Report (DSR) for the sampling activities described in the QAPP. The Report will describe the field activities performed during implementation of the QAPP and the physical characteristics of the study area. The Report will include field documentation, documentation of field QC procedures, and results of all field and laboratory measurements and analyses. The Report will also contain a discussion of the data quality assessment. The data quality discussions will contain, on a routine basis, the results of any associated field and laboratory measurements and analyses, information generated on the achievement of specific DQOs, and a summary of any corrective actions that were implemented and their immediate results on the project. A detailed listing of any deviations from the approved QAPP will also be provided with an explanation for each deviation and a description of the effect on data quality and usability, if any.

The CPM and QAO are responsible for preparation of the Report. The Report will be submitted in draft form to the EPA for review. Upon receipt of comments, the draft Report will be revised to address the comments and resubmitted to the EPA for final approval.

5.0 DATA VALIDATION AND USABILITY

The following sections address the final project checks conducted after the data collection phase of the project is completed to confirm that the data obtained meet the project objectives and to estimate the effect of any deviations on data usability.

5.1 Data Validation and Verification

The process to be used for reviewing and verifying field data and the internal laboratory data reduction process are described in the following sections. Laboratory data reporting requirements, which describe how results are conveyed to data users, are also discussed.

5.1.1 Field Data Review

Raw field data shall be entered in field logbooks or on electronic field forms, which shall be reviewed for accuracy and completeness by the Field Team Leader before those records are considered final. The overall quality of the field data from any given sampling round shall be further evaluated during the process of data reduction and reporting.

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Field data review will include verification that any QC checks and calibrations, if necessary, are recorded properly in the field logbooks and/or on electronic forms and that any necessary and appropriate corrective actions were implemented and recorded. QC checks, calibrations, and any corrective actions will be written into field logbook and/or recorded on electronic forms immediately after they occur. If errors are made in logbooks, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. If mistakes are made in electronic forms, the original form and output file are preserved, a revised output file is developed, and the data in the replacement file is entered into the database. In a reasonable time frame, the Field Team Leader will proof the field logbooks and electronic field forms to determine whether any transcription errors have been made by the field crew. If transcription errors have been made, the Field Team Leader and field crew will address the errors to provide resolution.

Appropriate field measurement data will be uploaded from electronic field forms for project database entry. Data entries will be made directly from electronic field forms which have been reviewed for accuracy and completeness, prior to submittal to the database manager. Electronic files of field measurement data will be maintained as part of the project's quality records.

Should the database manager, or a data user, find suspect data, the suspect data point will be investigated. If the data point is found to be in error, it will be corrected in the database, and the database manager will be responsible for any necessary notifications of the data revision or redistributions of the data.

5.1.2 Laboratory Data Review

Internal laboratory data reduction procedures will be according to each laboratory's Quality Management Plan. At a minimum, records shall be maintained by the analysts to document sample identification number and the sample tag number with sample results and other details, such as the analytical method used (e.g., method SOP #), name of analyst, the date of analysis, matrix sampled, reagent concentrations, instrument settings and the raw data. These records shall be signed and dated by the analyst. Secondary review of these records by the Laboratory Supervisor (or designee) shall take place prior to final data reporting to Atlantic

Richfield. The laboratory shall appropriately flag unacceptable data in the data package. Shall any deficiencies with the potential to change analytical results be found during laboratory review of previously reported data, Atlantic Richfield, or their representative, will be immediately notified, and a revised report and EDD will be issued.

5.1.3 Laboratory Data Reporting Requirements

The laboratory shall prepare electronic data packages for transmittal of results and associated QC information to Atlantic Richfield or their designee. At a minimum, the standard data packages shall include the case narrative, and all sample results, units and quality control sample results. Standard data packages shall be transmitted to Atlantic Richfield or their designee within 14 days of laboratory sample receipt. Level IV data packages shall be transmitted to Atlantic Richfield or their designee within 28 days of laboratory sample receipt.

The laboratory shall prepare electronic data packages for transmittal of results and associated QC information to Atlantic Richfield, or their designee, in general accordance with the EPA's Contract Laboratory Program (CLP) Statement of Work. Deviations from these specifications may be acceptable provided the electronic report presents all of the requested types of information in an organized, consistent and readily reviewable format.

5.1.4 Laboratory Electronic Data Deliverable

Each electronic data package, as described above, shall be accompanied by an EDD prepared by the laboratory. Additional laboratory QC data can be included in the EDD. EDDs will be cross checked against corresponding data reports to confirm consistency in results reported in these two separate formats. This cross check will take place as part of the data review process.

5.1.5 Specific Quality Control/Assessment Procedures

The accuracy, precision, completeness and representativeness of analytical data will be described relative to the project's control limits through a process of field and laboratory data quality review. Results from these reviews will be documented in a Data Quality Assessment Report prepared for all data users. Any qualification of the data resulting from that review will also be incorporated into the project's electronic database so that all data users are aware of any uncertainties associated with individual results.

5.2 Internal Data Review

Data review is the process of verifying that information generated relative to a given sample is complete and accurate. Data review procedures shall be performed for both field and laboratory operations as described below.

5.2.1 Field Quality Control Data

The results of field quality control sample analyses associated with each laboratory data package will be reviewed to allow for evaluation of field blanks and other field QC samples and further indications of the data quality. If a problem is identified through the review of field QC data, all related field samples will be identified, and if possible, corrective actions can be instituted and documented on a CAR. In the event that corrective action requests are not in complete accordance with approved project planning documents, the EPA will be consulted and concurrence will be obtained before the change is implemented. If data are compromised due to a problem identified via field QC sample review, appropriate data qualifications will be used to identify the data for future data users. These qualifiers will be included with tabulated data presented in the Data Assessment section of DSRs.

The handling, preservation and storage of samples collected during the sampling program will be monitored on an on-going basis. The project laboratories will document sample receipt including proper containers and preservation at the time samples are logged in by the laboratory. The sample receipt records (a required data package deliverable), as well as the chain-of-custody documentation, will also be assessed during data review.

5.2.2 Laboratory Chemistry Data

The second level of review will be performed by the QAO, or their designee, and will include a review of laboratory performance criteria and sample-specific criteria. One hundred percent of the data will be reviewed and validated. Data validation will follow the *Standard Operating Procedure Validation of Inorganic Chemistry Data for CFRSSI* (TREC, 2017). The *Standard Operating Procedure Validation of Inorganic Chemistry Data for CFRSSI* incorporates validation guidelines from the *National Functional Guidelines for Inorganic Superfund Method Data Review* (EPA, 2017), and adheres to criteria set forth in the *EPA Contract Laboratory Program Statement of Work ISMO2.4* (EPA, 2016). An additional responsibility of the QAO will be to determine whether the DQOs have been met and calculate the data completeness for the project.

Data quality review is a process to determine if the data meet project-specific DQOs. The data quality review will include verification of the following:

- Compliance with the QAPP,
- Proper sample collection and handling procedures,
- Holding times,
- Field QC results,
- Instrument calibration verification,
- Laboratory blank analysis,
- Detection limits,
- Laboratory duplicates,
- MS/MSD percent recoveries and relative percent differences,
- Surrogate percent recoveries,
- Data completeness and format, and
- Data qualifiers assigned by the laboratory.

Qualifiers that may be applied to the data include the following (also found in Exhibit 3):

U The analyte was analyzed for but was not detected above the reporting limit.

J The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.

J+ The result is an estimated quantity, but the result may be biased high.

J- The result is an estimated quantity, but the result may be biased low.

UJ The analyte was not detected above the sample reporting limit. However, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

A Data Quality Assessment (DQA) will be performed to determine whether the project-specific DQOs have been satisfied. The DQA is an expansion of the data quality review and consists of five steps that relate the quality of the results to the intended use of the data:

Step 1: Review DQOs and sampling design

Step 2: Conduct preliminary data review

Step 3: Apply Statistical test(s) as described in this QAPP to the data set

Step 4: Verify assumptions

Step 5: Draw conclusions about the quality of the data (data report will not include interpretation of results but will state conclusions regarding the quality of the results).

QA/QC will be completed for each sampling work order to determine if field procedures meet the sampling guidelines and will be assigned a Level A/B designation. Based upon the DQA process, data will be assigned to one of three data utilization categories: enforcement quality, screening quality, and unusable data. Enforcement quality (unrestricted use) data result from, and were supported by, rigorous sampling and analysis protocols. Screening quality data resulted from less rigorous sampling and analysis procedures than enforcement quality data; they were qualified data which could not be justified for use as enforcement quality and/or lack Level B documentation. Unusable data result from inadequate sampling, analysis, and/or documentation procedures, and therefore are not used in storm water quality evaluation.

If, as a result of the DQA process, it is determined that data do not satisfy all DQOs, then corrective action(s) should be recommended and documented in the data reporting. Corrective actions include, but are not limited to, revision of the DQOs, based on the results of the investigation, or collection of more information or data. It may be determined that corrective actions are not required, or the decision process may continue with the existing data, with recognition of the limitations of the data.

A laboratory data validation checklist is included in Appendix D Exhibit 1. This checklist also incorporates field QC. A level A/B criteria screening checklist is included in Appendix D Exhibit 2.

Results of the QA review and/or validation will be included in any subsequent report, which will provide a basis for meaningful interpretation of the data quality and evaluate the need for corrective actions.

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Tables

Table 3 - Flow Measurement Monitoring Sites, Frequency, and Monitoring Method

Site	Creek Normal Flow Monitoring	Creek Wet Weather Monitoring	Sub-Drainage Wet Weather Diagnostic Monitoring
SS-01	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter and Solinst pressure transducer	N/A
GG-BTC	N/A	Continuous Stage Monitoring with ISCO Flow Meter	N/A
SS-01.6	Monthly Manual Flow Measurement with portable flow meter Continuous Stage Monitoring Apr-Dec	N/A	N/A
SS-04	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter. Monitored by USGS	N/A
SS-05	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter and H350 stage recorder	N/A
SS-05.7	Monthly Manual Flow Measurement with portable flow meter	N/A	N/A
SS-05A	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter and H350 stage recorder	N/A
SS-06A	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter	N/A
SS-06G	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter	N/A
SS-07	Monthly Manual Flow Measurement with portable flow meter	Continuous Stage Monitoring with ISCO Flow Meter. Monitored by USGS	N/A
AR-MH-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
BG-CH-0	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter

Site	Creek Normal Flow Monitoring	Creek Wet Weather Monitoring	Sub-Drainage Wet Weather Diagnostic Monitoring
BG-CLV-B3	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
BG-CH-C1A	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
BG-CLV-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
GG-CH-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
LC-CLV-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
MG-CLV-0	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
MPTP-CLV-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
MSD-CLV-3A	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter and Sutron Stage Recorder
MSD-CLV-CASEY	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
TX-HD-OUT	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter
WA-CLV-1	N/A	N/A	Continuous Flow Monitoring with ISCO A-V Meter

Table 4 – Water Quality Monitoring Sites, Frequency, and Sampling Method

Site	Creek Normal Flow Monitoring	Creek Wet Weather Monitoring[1]	Sub-Drainage Wet Weather Diagnostic Monitoring[2]
SS-01	Manual Monthly Sample	ISCO 3700 and D-TEC, ISCO Signature Flow Meter for continuous pH monitoring	N/A
GG-BTC	N/A	ISCO 3700 and D-TEC	N/A
SS-01.6	Manual Monthly Sample	N/A	N/A
SS-04	Manual Monthly Sample	ISCO 3700 and D-TEC	N/A
SS-05	Manual Monthly Sample	ISCO 3700 and D-TEC	N/A
SS-05.7	Manual Monthly Sample	N/A	N/A
SS-05A	Manual Monthly Sample	ISCO 3700 and D-TEC	N/A
SS-06A	Manual Monthly Sample	ISCO 3700 and D-TEC	N/A
SS-06G	Manual Monthly Sample	ISCO 3700 and D-TEC, ISCO Signature Flow Meter for continuous pH monitoring	N/A
SS-07	Manual Monthly Sample	ISCO 3700 and D-TEC, ISCO Signature Flow Meter for continuous pH monitoring	N/A
AR-MH-1	N/A	N/A	ISCO 3700
BG-CLV-B3	N/A	N/A	ISCO 3700
BG-CH-C1A	N/A	N/A	ISCO 3700
BG-CLV-1	N/A	N/A	ISCO 3700
GG-CH-1	N/A	N/A	ISCO 3700
LC-CLV-1	N/A	N/A	ISCO 3700
MG-CLV-0[3]	N/A	N/A	ISCO 3700
MPTP-CLV-1	N/A	N/A	ISCO 3700
MSD-CLV-3A	N/A	N/A	ISCO3700

Site	Creek Normal Flow Monitoring	Creek Wet Weather Monitoring[1]	Sub-Drainage Wet Weather Diagnostic Monitoring[2]
MSD-CLV-CASEY	N/A	N/A	ISCO 3700
TX-HD-OUT	N/A	N/A	ISCO 3700
WA-CLV-1	N/A	N/A	ISCO 3700
SS-CB8	N/A	N/A	D-TEC
WSD	N/A	N/A	D-TEC

[1] All Creek Wet Weather sites will be sampled at a frequency as determined by actual rain events that cause creek conditions to meet the general wet weather sampling criteria as defined in the Wet Weather Criteria SOP in Appendix B.

[2] All Sub-Drainage Wet Weather Diagnostic sites will be sampled at a frequency as determined by actual rain events over 0.15" and up to two events per month.

[3]Opportunistic sampling may occur at this location due to O&M activities at Missoula Gulch basins. Sampling event will be triggered by a notification from BSB that O&M activities are being conducted

Table 5 – Opportunistic Water Quality Monitoring Sites, Frequency, and Sampling Method

Site	Creek Normal Flow Monitoring	Sub-Drainage Wet Weather Diagnostic Monitoring[2]
BG-CLV-01		3/22/18: Manually sampled in response to turbid run-off which appeared to contain petroleum product
MSD-CLV-Casey		5/4/18: ISCO 3700; triggered sampler to collect run-off occurring in response to Civic Center parking lot cleaning
SS-01	3/12/18: Manually sampled in response to turbid run-off which appeared to contain petroleum product	
SS-CB8		9/7/18: Manually sampled due to presence of blue sludge type material following dye investigation of BSB sanitary sewers
WA-CLV-1		5/4/18: ISCO 3700; triggered sampler to collect run-off occurring in response to Civic Center parking lot cleaning 7/28/18: ISCO 3700; sampler collected for unknown reason. Street cleaning, heavy irrigating at McGruff Park, and dust control at Parrot Tailings removal all occurring in this time period.
WSD		9/7/18: Manually sampled in conjunction with SS-CB8 sample. No unusual material present at WSD.

Table 6 – Monitoring Site Coordinates and Location Description

Site	Coordinates		Description
	Latitude	Longitude	
SS-01	45.985271	-112.507762	Blacktail Creek (BTC) USGS Station at Harrison Ave, upstream of the BPSOU.
GG-BTC	45.991446	-112.528288	Grove Gulch sub-drainage monitoring station located upstream of SS-04 and below the Clark Tailings repository; located on BTC at outlet culvert from GG.
SS-01.6	45.992162	-112.529767	Blacktail Creek station downstream of Lexington Ave bridge.
SS-04	45.994635	-112.536114	Blacktail Creek USGS station upstream of its confluence with the MSD near George Street.
SS-05	45.995769	-112.539176	SBC station at Montana Street, downstream of the MSD-BTC confluence and below the BG outfall.
SS-05.7	45.996733	-112.542836	Station located in SBC rebuilt floodplain, downstream of SS-05 and upstream of old SBC diversion channel.
SS-05A	45.996215	-112.544249	Station located at the beginning of the SBC rebuilt floodplain and the east end of LAO, and downstream of old SBC diversion channel.
SS-06A	45.994484	-112.551751	Station located in rebuilt SBC floodplain upstream of the Montana Pole Treatment Plant (MPTP) effluent discharge.
SS-06G	45.996413	-112.562797	Station located at end of the SBC rebuilt floodplain at the west end of LAO, downstream of the Montana Pole Treatment Plant and Butte Treatment Lagoons discharge points and upstream of the historic HCC outlet and the Butte Metro Sewage Treatment Plant effluent.
SS-07	45.996626	-112.563646	Station located downstream of all BPSOU drainage outfalls as SBC exits the OU near Interstate 90.

Site	Coordinates		Description
	Latitude	Longitude	
AR-MH-1	46.001245	-112.519323	Provides diagnostic monitoring for the AR drainage just upstream of where the drainage enters the MSD and which primarily collects an industrial area.
BG-CH-0	45.995788	-112.537975	Provides diagnostic monitoring for the entire BG drainage just before confluence with SBC.
BG-CLV-B3	45.997293	-112.535472	Provides diagnostic monitoring downstream of rail yard.
BG-CH-C1A	45.998829	-112.524806	Culvert outlet that monitors East Buffalo Gulch just before the drainage enters the MSD. Upstream of BG-CH-C1.
BG-CLV-1	45.996249	-112.537154	Provides diagnostic monitoring upstream of BG-CH-0
GG-CH-1	45.989613	-112.528865	Provides diagnostic monitoring of the GG drainage just before entering BTC. This drainage is primarily urban.
LC-CLV-1	46.001692	-112.513436	Located in a culvert on Locust Street just prior to discharge into the uSBC. This will provide diagnostic monitoring at the bottom of a large basin east of the uSBC.
MG-CLV-0	45.996758	-112.544017	Provides diagnostic monitoring of Missoula Gulch discharge entering into Silver Bow Creek between SS-05A and SS-05B.
MPTP-CLV-1	45.994099	-112.548682	Provides diagnostic monitoring for the Montana Pole Treatment Plant surface water runoff entering into Silver Bow Creek between SS-05A and SS-06A.
MSD-CLV-3A	45.995375	-112.530662	Post reclamation uSBC station located upstream of its confluence with BTC, just east of Kaw Ave, and upstream of the end of the sub-drain collection pipe.

Site	Coordinates		Description
	Latitude	Longitude	
MSD-CLV-CASEY	45.999133	-112.521888	Provides diagnostic monitoring for the section of the uSBC from Casey Ave. to Texas Ave. There are several pipe inlets to the MSD in this stretch.
TX-HD-OUT	46.002462	-112.512355	Provide diagnostic monitoring of the large urban area to the southeast of the uSBC just before the drainage enters the uSBC.
WA-CLV-1	46.001384	-112.517010	Provides diagnostic monitoring of Warren Avenue prior to discharge entering uSBC
SS-CB8	46.002662	-112.550091	Missoula Gulch station that monitors MG and WSD outfalls prior to entering Catch Basin 8.
WSD	46.003850	-112.550261	West side drainage (WSD) channel downstream of WS-1 culvert.

Table 8 – Summary of Laboratory Quality Assurance/Quality Control Checks

Laboratory QC	Analysis	Method	Frequency[1]	Control Limits[1]	Corrective Action[2]
Method Blank (MB)	Metals	SW846 6020A&B	One in every 20 samples	< 1/2 RL	If > 1/2 RL the lowest concentration in associated samples must be >10X the MB result. If this is not true, all associated samples <10x MB and > RL should be redigested (if applicable) and reanalyzed. If MB <(-RL), all associated samples <10X RL should be redigested and reanalyzed.
	Mercury	SW846 7470A			
	Alkalinity	SM 2320B			
	Chloride	EPA 300.0			
	Sulfate	EPA 300.0			
	TDS	SM 2540C			
Laboratory Control Spike (LCS)	Metals	SW846 6020A&B	One in every 20 samples	80-120% of true value	Terminate analysis, correct problem, redigest (if applicable) and reanalyze all samples prepared with non-compliant LCS.
	Mercury	SW846 7470A			
	Alkalinity	SM 2320B			
	Chloride	EPA 300.0		90-110% of true value	
	Sulfate	EPA 300.0			
	TDS	SM 2540C		80-120% of true value	
Laboratory Control Spike Duplicate (LCSD)	Alkalinity	SM 2320B	One in every 20 samples	20% RPD	Flag data
	TDS	SM 2540C			
Laboratory Duplicate	Metals	SW846 6020A&B	One in every 20 samples	20% RPD for	Should LDS samples fail

Laboratory QC	Analysis	Method	Frequency[1]	Control Limits[1]	Corrective Action[2]
Sample (LDS)	Mercury	SW846 7470A		samples ≥ 5X CRQL, is sample or duplicate value < 5X CRQL control limit is an absolute difference between sample and dupe of the CRQL.	to meet control limits, and the samples in the associated batch are of a similar matrix, then associated sample results should be flagged. Results greater than the method detection limit (MDL) should be flagged as estimated, and results less than the MDL should be flagged as estimated non-detect. If samples in the associated batch are not similar to the parent sample used for the LDS, then only the parent sample used to prepare the duplicate should be flagged.
	Alkalinity	SM 2320B			
	Chloride	EPA 300.0			
	Sulfate	EPA 300.0			
	TDS	SM 2540C	One in every 10 samples		
Matrix Spike (MS)/Matrix Spike	Metals	SW846 6020A&B	One in every 20 samples	75-125% of true value, 20% RPD	Should MS/MSD samples fail to meet

Laboratory QC	Analysis	Method	Frequency[1]	Control Limits[1]	Corrective Action[2]
Duplicate (MSD)	Mercury	SW846 7470A			control limits, and the samples in the associated batch are of a similar matrix, then associated sample results should be flagged. If samples in the associated batch are not similar to the parent sample used for the MS/MSD, then only the parent sample used to prepare the spike should be flagged. MS/MSD% recovery criteria are waived if parent sample concentration is >4X spike concentration.
	Chloride	EPA 300.0	One in every 10 samples	90-110% of true value, 20% RPD	
	Sulfate	EPA 300.0			

[1]Frequency and control limits are based on US EPA National Functional Guidelines for Superfund Inorganic Data Review (EPA, 2017), EPA Method 300.0 Determination of Inorganic Anions by Ion Chromatography (Pfaff, 1993), and *EPA Contract Laboratory Program Statement of Work ISM02.3* (EPA, 2015) or *EPA Contract Laboratory Program Statement of Work ISMO2.4* (EPA, 2016), and CFRSSI LAP (ARCO, 1992a)
[2]Corrective actions are sequential for cases indicating multiple corrective actions. If the first corrective action is not sufficient to bring analysis back into control, the second action noted will be implemented.

Table 9 – Creek Monitoring Parameter List and Associated Analytical Methods, Approximate Method Detection Limits, Reporting Limits, and Holding Times

Analyte	Precision	Accuracy	Holding time (days)	Method	Source	Event Monitored
Field Parameters						
Dissolved Oxygen (mg/L)	0.01	$\pm$ 2%	Field measured	Multimeter	CFRSSI SOPs	NF
Temperature (°C)	0.1	$\pm$ 0.1	Field measured	Multimeter	CFRSSI SOPs	NF
pH (s.u.)	0.01	$\pm$ 0.02	Field measured	Multimeter	CFRSSI SOPs	NF
Specific Conductivity (µs/cm)	1	$\pm$ 0.5%	Field measured	Multimeter	CFRSSI SOPs	NF
Trace Elements – Total Recoverable and Dissolved Fractions[1] (ug/L)						
Analyte	**Reporting Limit (µg/L)**	**MDL (µg/L)**	**Holding time (days)**	**Method**	**Source**	**Event Monitored**
Aluminum	10	1.5	180 Days	200.8 CLP-M	EPA	NF, WW
Arsenic	0.5	0.25	180 Days	200.8 CLP-M	EPA	NF, WW
Cadmium	0.08	0.033	180 Days	200.8 CLP-M	EPA	NF, WW
Dissolved Calcium	40	8.4	180 Days	200.8 CLP-M	EPA	NF, WW
Copper	1	0.22	180 Days	200.8 CLP-M	EPA	NF, WW
Iron	50	8	180 Days	200.8 CLP-M	EPA	NF, WW
Lead	0.1	0.046	180 Days	200.8 CLP-M	EPA	NF, WW
Dissolved Magnesium	10	2.8	180 Days	200.8 CLP-M	EPA	NF, WW
Mercury	0.01	0.002	28 Days	245.1 CLP-M	EPA	NF, WW
Molybdenum	0.09	0.069	180 Days	200.8 CLP-M	EPA	NF, WW
Silver	0.5	0.056	180 Days	200.8 CLP-M	EPA	NF, WW
Zinc	5	2.5	180 Days	200.8 CLP-M	EPA	NF, WW

General Laboratory (mg/L)						
Analyte	**Reporting Limit (mg/L)**	**MDL (mg/L)**	**Holding time (days)**	**Method**	**Source**	**Event Monitored**
Hardness (as $CaCO_3$)	0.071	0.036	180 Days	EPA 200.8	EPA	NF, WW
Alkalinity (as $CaCO_3$)	5	2.5	14 Days	SM 2320B[3]	EPA	NF, WW
Nitrate + Nitrite	0.1	0.05	28 Days	SM 4500-NO_3 H[3]	EPA	NF, WW
Sulfate	2.5	1.2	28 Days	ASTM D516	EPA	NF, WW
TDS	10	5	7 Days	SM 2540C[3]	EPA	NF, WW
TSS	10	5	7 Days	SM 2540D[3]	EPA	NF, WW
Additional Parameters (mg/L) (only applied to stations: SS-01, SS-06G, SS-07)						
Analyte	**Precision**	**Accuracy**	**Holding time (days)**	**Method**	**Source**	**Event Monitored**
pH (s.u.)	0.01	$\pm$ .02	Continuously field measured	ISCO Signature Flow meter	CFRSSI SOPs	WW
Analyte	**Reporting Limit (mg/L)**	**MDL (mg/L)**	**Holding time (days)**	**Method**	**Source**	**Event Monitored[2]**
Ammonia	0.04	0.02	28 Days	EPA 350.1	EPA	NF, WW
Dissolved Organic Carbon	0.5	0.17	28 Days	SM 5310C[4]	EPA	NF, WW
Total Kjeldahl Nitrogen	0.2	0.065	28 Days	EPA 351.2	EPA	NF, WW
Total Phosphorus	0.05	0.025	28 Days	SM4500P-E[3]	EPA	NF, WW

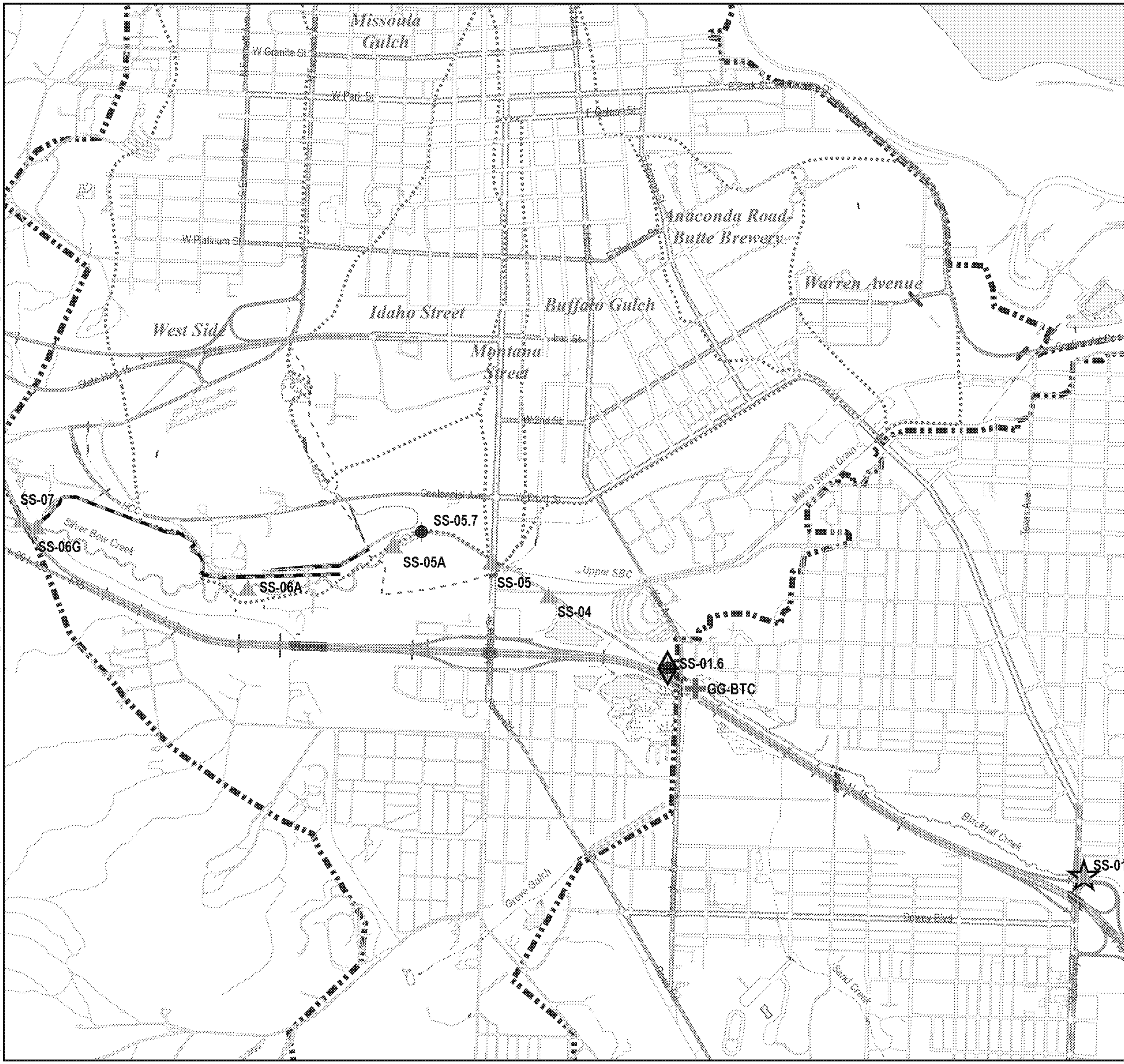
[1] Calcium and Magnesium dissolved fraction only
[2] NH_3, DOC, TKN, and Total P collected only for the first WW event of the month
[3] Standard method run by 1997 edition
[4] Standard method run by 2000 edition

Table 13– Creek Monitoring Analytical Bottle Count and Preservative Addition

Analytes	Sampling Container	Preservative	Filter	Comments
General Laboratory				
Alkalinity (as $CaCO3$)	Polyethylene, 1 x 1 L	None, refrigerate 0°C-6°C	None	Only one container for all five analyses
Hardness (as $CaCO3$)	Polyethylene, 1 x 1L	None, refrigerate 0°C-6°C	None	
Sulfate	Polyethylene, 1 x 1 L	None, refrigerate 0°C-6°C	None	
Total Dissolved Solids	Polyethylene, 1 x 1 L	None, refrigerate 0°C-6°C	None	
Total Suspended Solids	Polyethylene, 1 x 1 L	None, refrigerate 0°C-6°C	None	
Inorganic Chemicals				
Ammonia	Polyethylene, 1 x 250 mL	pH<2 sulfuric acid, refrigerate 0°C-6°C	None	Only one container for all three analyses
Nitrate+Nitrite	Polyethylene, 1 x 250 mL	pH<2 sulfuric acid, refrigerate 0°C-6°C	None	
Total Phosphorous	Polyethylene, 1 x 250 mL	pH<2 sulfuric acid, refrigerate 0°C-6°C	None	
Metals				
Dissolved Metals[A]	Polyethylene, 1 x 250 mL	pH<2 nitric acid, refrigerate 0°C-6°C	0.45-micron filter	Only one bottle for all analyses
Total Metals[B]	Polyethylene, 1 x 250 mL	pH<2 nitric acid, refrigerate 0°C-6°C	None	Only one bottle for all analyses
Additional Parameters				
Dissolved Organic Carbon	Amber Glass, 1 x 250 mL	pH<2 sulfuric acid, refrigerate 0°C-6°C	0.45-micron filter	-
Total Kjeldahl Nitrogen	Polyethylene, 1 x 250 mL	pH<2 sulfuric acid, refrigerate 0°C-6°C	None	-

[A]Dissolved metals analysis includes: Aluminum, Arsenic, Cadmium, Calcium, Copper, Iron, Lead, Magnesium, Mercury, Molybdenum, Silver, and Zinc.
[B]Total metals analysis includes: Arsenic, Cadmium, Copper, Iron, Lead, Mercury, Molybdenum, Silver, and Zinc.

Figures



Atlantic Richfield Company
A BP affiliated company

2018 Surface Water Quality Assurance Project Plan

Butte Priority Soils Operable Unit

Normal Flow and Wet Weather Monitoring Locations - Figure 1

N

Legend

- Wet Weather & Normal Flow Sampling, Continuous Stage
- Wet Weather Sampling, Continuous Stage
- Normal Flow Sampling, Manual Flow
- Opportunistic Sample Collected
- Continuous Stage Apr-Dec

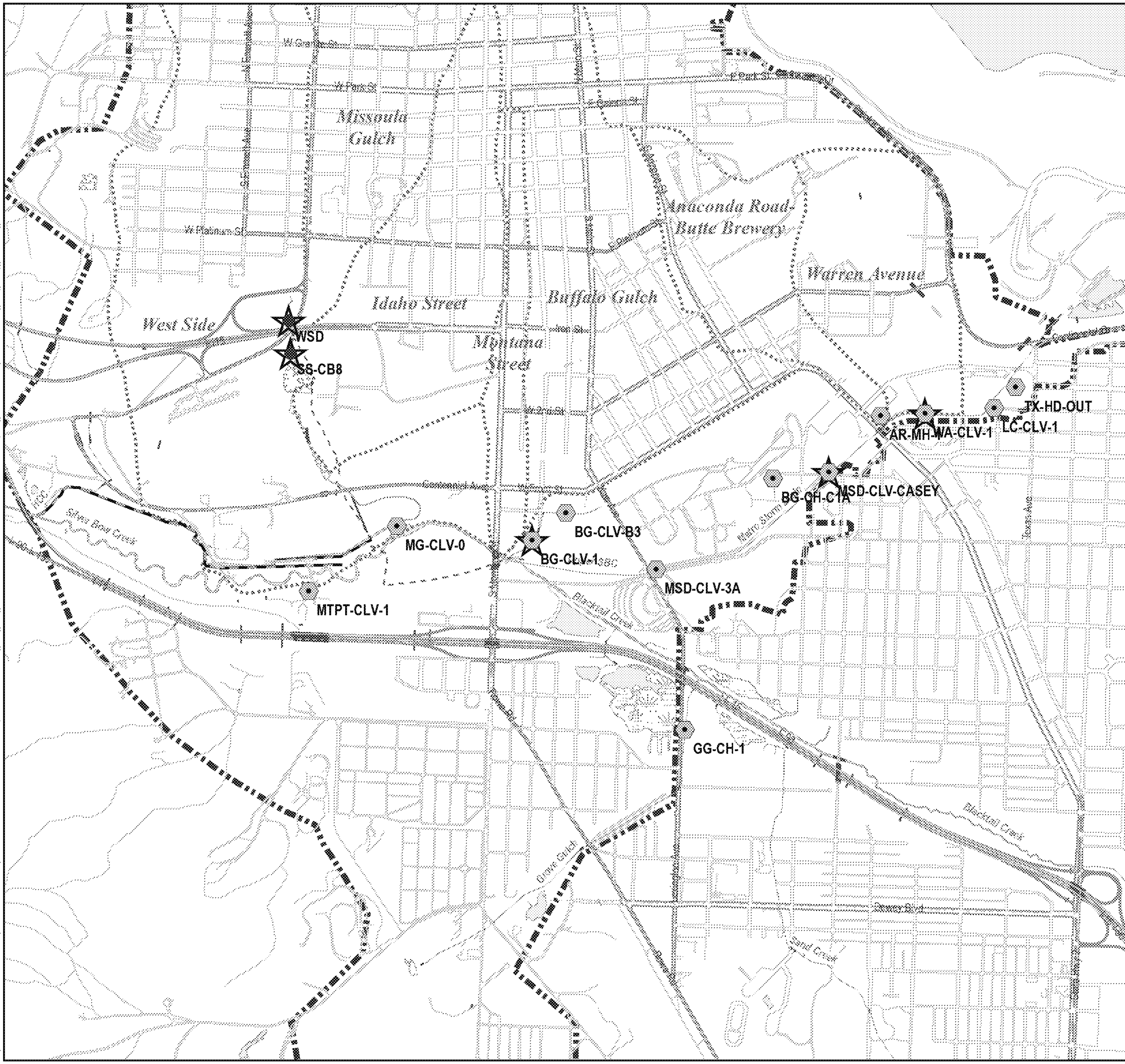
900 450 0 900 1,800 Feet

TREC, Inc.
Engineering & Environmental Management

A Woodard & Curran Company

Project #: 0231347.00
Map Created: December 2018

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:**



Atlantic Richfield Company
A BP affiliated company

2018 Surface Water Quality Assurance Project Plan

Butte Priority Soils Operable Unit

Sub-drainage Diagnostic Monitoring Locations - Figure 2

N

Legend

- D-TEC Sampler
- ISCO Sampler and Continuous Flow
- Opportunistic Sampling

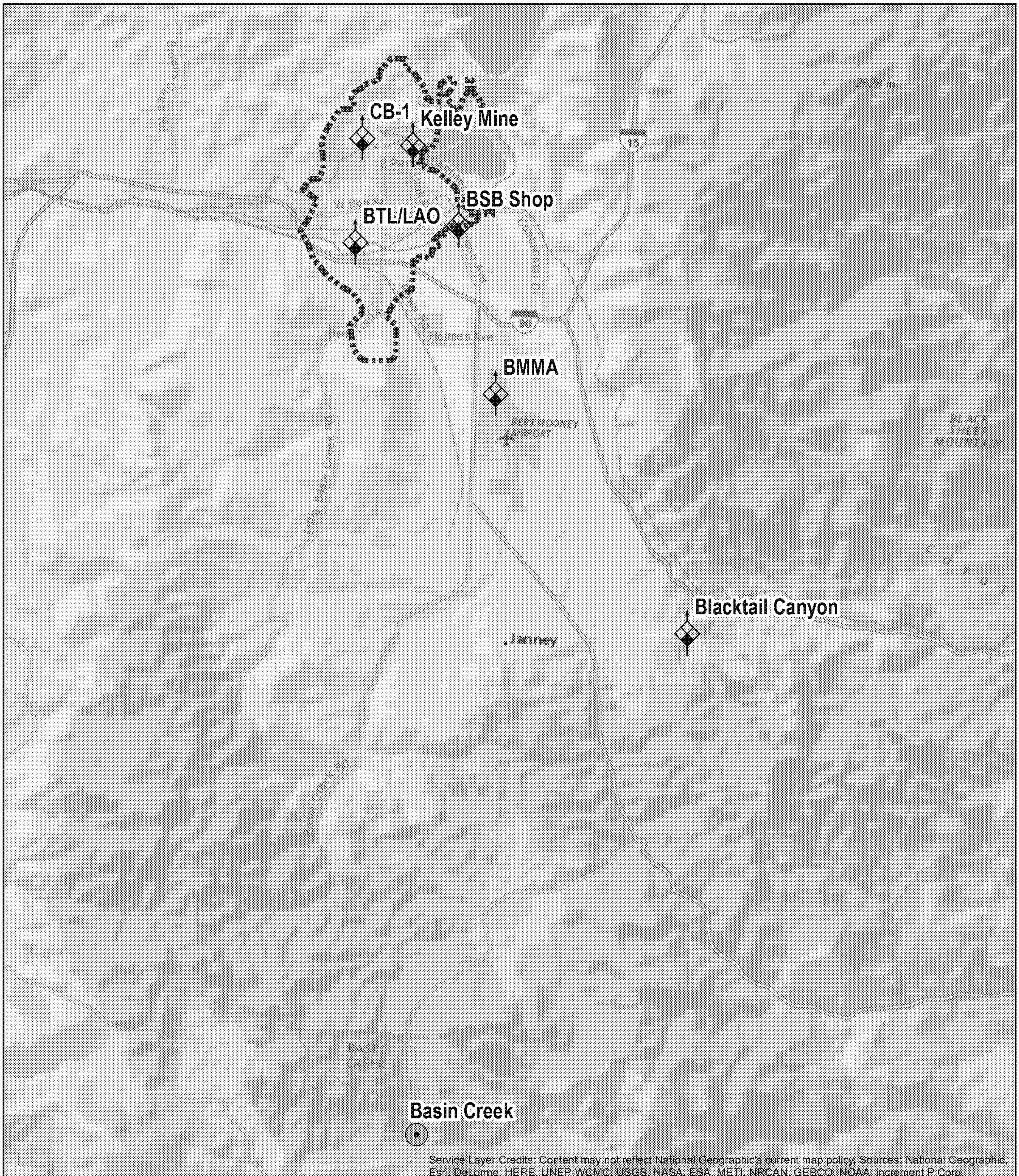
750 375 0 750 1,500 Feet

TREC, Inc.
Engineering & Environmental Management

A Woodard & Curran Company

Project #: 0231347.00
Map Created: December 2018

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:**



Atlantic Richfield Company
A BP affiliated company

2018 Surface Water Quality Assurance Project Plan

Butte Priority Siols Operable Unit

Vicinity Climate Stations - Figure 3

Legend

Precipitation Guage

BPSOU Boundary

Snow Pillow

N

0 0.5 1 2 Miles

TREC, Inc.
Engineering & Environmental Management
A Woodard & Curran Company

Project #: 0231347.00
Map Created: February 2018

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:**

APPENDIX A

Project Team Diagram

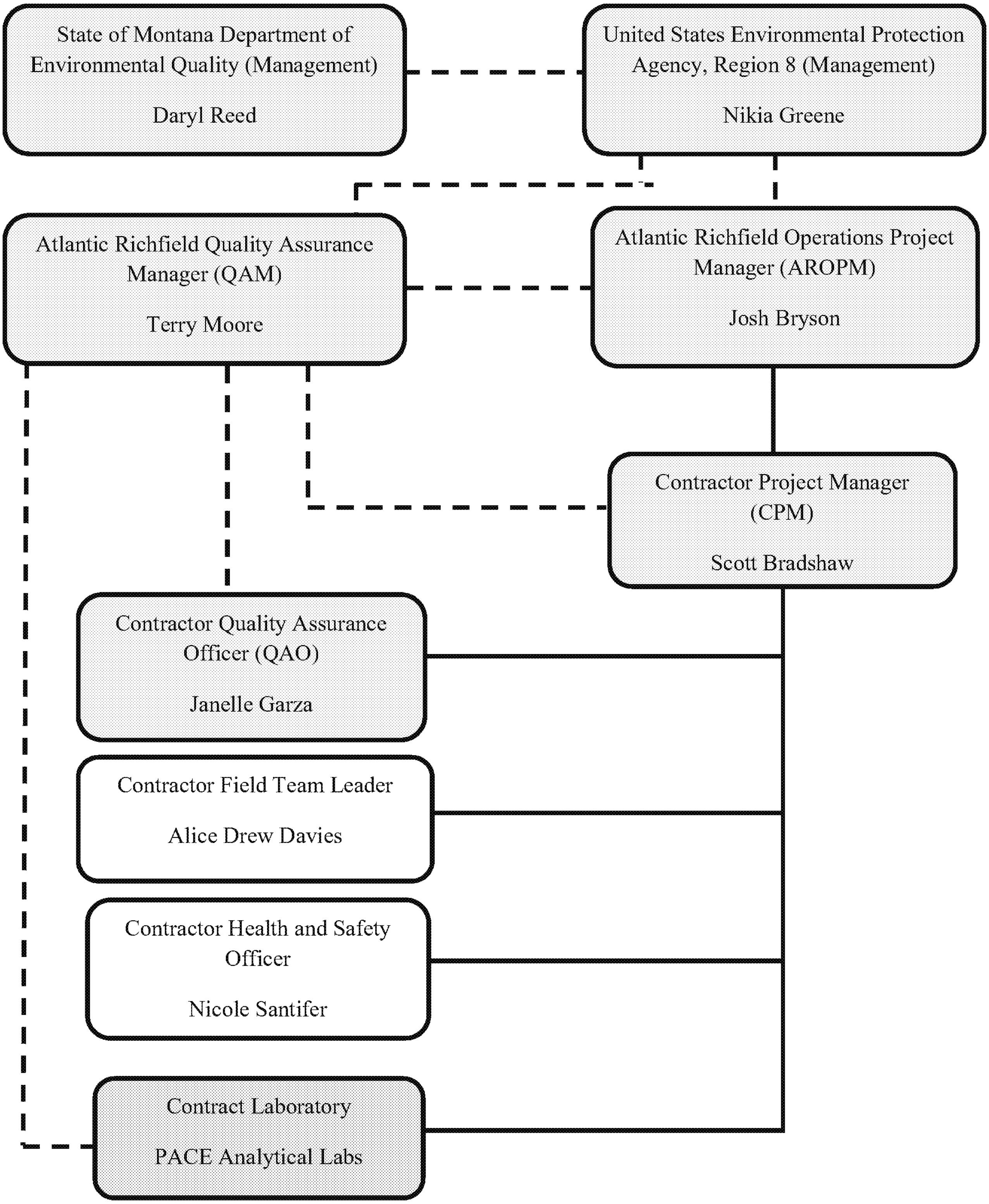


Figure 1 – BPSOU Surface Water Monitoring Team Organization

APPENDIX B

Standard Operating Procedures

STANDARD OPERATING PROCEDURE

BLACKTAIL AND SILVER BOW CREEK WET WEATHER SAMPLING TRIGGER CRITERIA

Updated: May 5th, 2018

1.0 Preparation

1.1 Current Stream Conditions

Prior to starting, current stream conditions are checked using available USGS station data available online. While observing data, note diurnal fluctuations and average stream discharge at all available and applicable sites.

- Blacktail Creek - SS-04 – USGS 12323240
  https://waterdata.usgs.gov/mt/nwis/uv/?site_no=12323240&PARAmeter_cd=00060,00065,00010
    - Normal SS-04 flows range from 10-20 CFS, and at flows in this range standard Wet Weather criteria of 35 CFS is generally used
- Silver Bow Creek - SS-07 – 12323250
  https://waterdata.usgs.gov/mt/nwis/uv/?site_no=12323250&PARAmeter_cd=00060,00065,00010
    - Normal SS-07 flows range from 20-30 CFS, and at flows in this range standard Wet Weather criteria of 50 CFS is generally used

1.2 Data Collection

During initial installation or upon observing that Wet Weather sampling stage criteria needs to be adjusted, all applicable and available stage data from stream sites should be downloaded to have the most current data. Generally, wet weather criteria are set at to flows of 35 and 50 CFS at SS-04 and SS-07, respectively, and their corresponding stage heights. Sometimes during initial sampler installation in the spring, peaks of 35 cfs at SS-04 and 50 cfs at SS-07 have not yet occurred; thus, USGS stage-discharge curves from the previous year have to be utilized until the creek reaches the intended criteria. While downloading is occurring, physical stream attributes should be noted, including turbidity, discharge from tributaries, etc.

After all data from applicable sites is obtained, enter the sites into a copy of the spreadsheet located:

\\wc\shared\Offices\Bozeman\BUTTE\TREC\ARCO\BPS-Storm\Events\Creek 2014_thru_2017\2018
file name: creek-stage_storm2018.

This spreadsheet uses the most recent stage-discharge curves to transform stage data to discharge data and plot all of the stations on the same chart for comparison purposes. If using USGS data for sites SS-04 and SS-07, instead of the data from the field downloads, it is necessary to adjust the times from MDT to MST. These hydrographs are used in Section 3.0.

Historical weather and precipitation data from all available and applicable online stations also needs to be collected prior to selection of sampling criteria.

- BTL/LAO - https://www.wunderground.com/personal-weather-station/dashboard?ID=KMTBUTTE5
- Kelley Mine Yard - https://www.wunderground.com/personal-weather-station/dashboard?ID=KMTBUTTE2

2.0 Storm Selection

2.1 Criteria

Ideal recent-historical storm for selection of sampling criteria had significant precipitation (usually > 0.10 in.) that was consistent across study area, occurred recently had an abrupt rising limb of the hydrograph, and had a clear singular peak before decreasing into the tailing limb of the hydrograph. Checking all available online resources including discharge and weather data, is necessary to pick an appropriate storm.

2.2 Comparisons

Looking at current stream conditions compared to selected storm for discharge differences. Making sure selected storm hits at least 25% above current levels to allow for diurnal variation.

3.0 Sampling Flow Selection

3.1 Target Flow Levels

Once the ideal recent-historical storm has been selected, target flow levels will be set for at least 25% above current stream conditions and 15 CFS above current stream conditions. This 25% is to allow for diurnal variation while still being sensitive enough to flow increases to catch the rising limb of the hydrograph. The 15 CFS is intended to allow for a significant storm event without having too many insignificant precipitation events trigger samplers. In addition, an increase in flow between SS-04 and SS-07 of at least 15 CFS is targeted to account for inputs between the two sites.

3.2 USGS Stations

Using the ideal recent-historical storm hydrograph, sampling flows and stages will be set for USGS sites (SS-04 and SS-07). It is important to note that samplers are always set to MST while data from USGS is reported consistent with the current time units (during daylight savings time, USGS sites report in MDT, during standard time, USGS sites report in MST). Therefore, when obtaining the date and time the creek reached criteria, 35 cfs at SS-04 and 50 cfs at SS-07, or other target levels, the time needs to be converted to MST. Normally standard flow targets are used when stream flows are between 10-20 CFS at SS-04 and 20-30 CFS at SS-07. If the current flow conditions are below standard flow target conditions, a flow target below standard flow targets will be selected. If the current flow conditions are above standard flow target conditions, a flow target above standard flow targets will be selected. Based on current conditions, a 15 CFS increase, plus 25% buffer for diurnal variation, and the ideal recent historical storm hydrograph, a target flow is selected for SS-04 and SS-07. For example, if the creek is flowing at 5 cfs at SS-04, 25% of flow would be 1.25 cfs. (5+1.25+15) for a target of approximately 21 cfs. Then a fifteen cfs increase in flow between SS-04 and SS-07 would set the target at SS-07 at approximately 36 cfs. This selected target flow should be just above the above-mentioned buffers for both SS-04 and SS-07. During the summer months, there is a significant amount of vegetation at SS-04 and the stage becomes elevated causing USGS to apply a shift. It is important to closely monitor and adjust accordingly. These flow values are checked by using the assumed travel time between SS-04 and SS-07 (2 hours) and the actual timing between sampling that would have occurred on the ideal recent-historical storm. Assumed travel times between each station are listed below in Table 1.

Table 1. Estimated Wet Weather Travel Times

Station	Estimated Travel Time from previous station (minutes)
SS-01	--
GG-BTC	1:15
SS-04	0:15
SS-05	0:15
SS-05A	0:15
SS-06A	0:30
SS-06G	0:30
SS-07	0:15

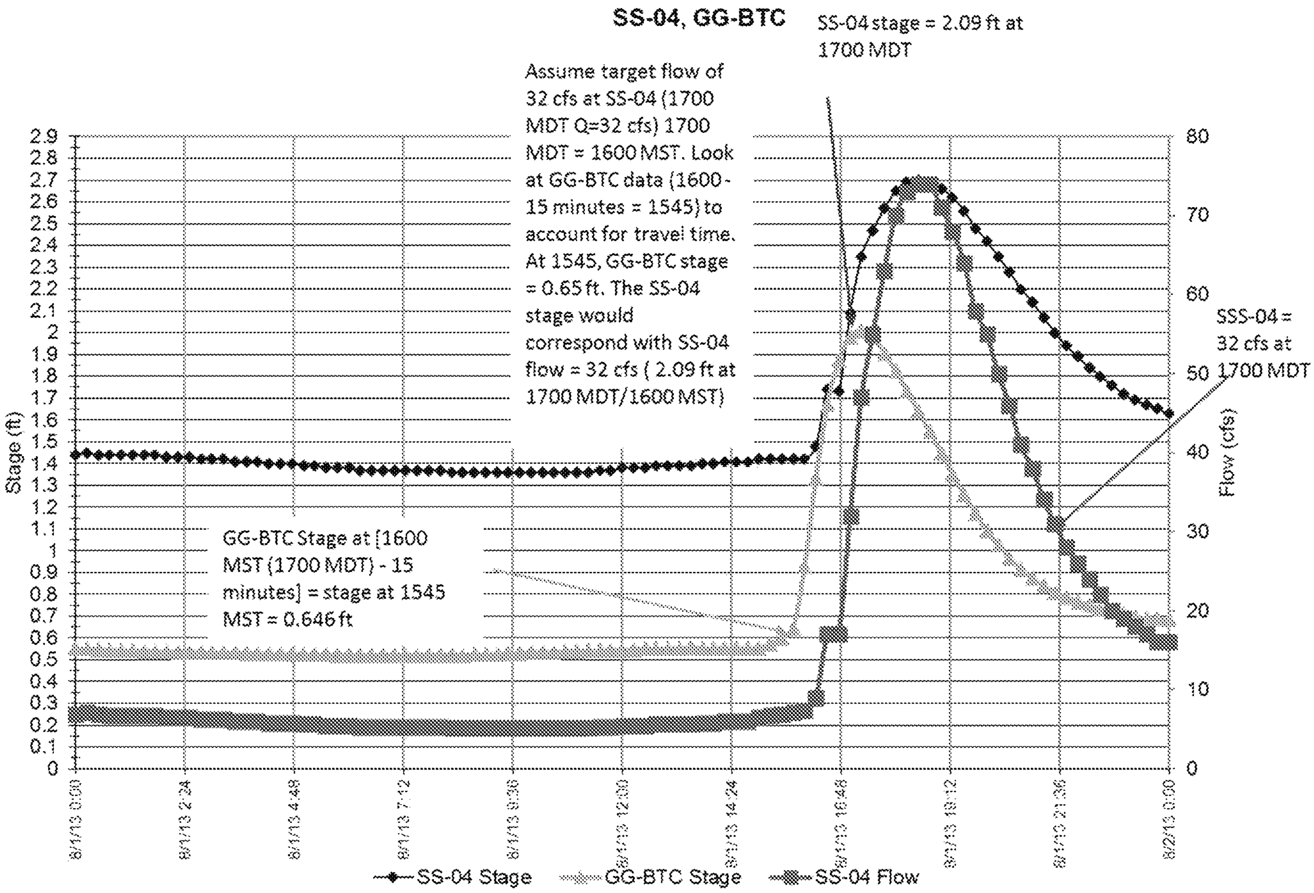
3.3 BPSOU Stations

Once target flow values are chosen for SS-04 and SS-07, using the hydrographs from the ideal recent-historical storm, determine estimated time of sample for all other stations using assumed travel times. If the hydrograph is changing at a very rapid rate, compare the stage you obtain with historical data to confirm.

4.0 Sampling Stage Selection

4.1 Stage-Discharge Relationship

Once estimated time of sample for each station is determined, target stage and flow for non-USGS stations can be decided. Using the recently downloaded stage data and the previous year's stage discharge relationship from the DSR (\\woodardcurran.net\shared\Projects\TREC\9208_AR_MT_BPSOU\9208 - 2009 BPSOU\9208-003_SW-GW_Monitoring\01_SurfaceWater\03_DSRs), create hydrographs for each station for the ideal recent-historical storm. Based on estimated time of sample for each site, use the hydrograph to determine target stage and the associated flow. While determining target stage and associated flow, use estimated time of sample for each site as a guide while also taking into account expected flow gains between stations and the cumulative flow gain that should be occurring between SS-04 and SS-07.



Section 3 through Section 4.1 is an iterative process that may require finding another ideal recent-historical storm to confirm target flow selection and travel time between sites.

4.2 Recording

Once all target flows and their associated stages have been determined, do a final check of those stages with the previous target stages to confirm that the stage is being properly adjusted up or down. If all stages and flows are determined acceptable, record the changed stage for each station in the associated smplr_flow spreadsheet and calculate the necessary change up or down in tenths of a foot and inches. Necessary change in stage should be calculated in both units to assist field team members when they are adjusting ISCO and D-TEC samplers.

SOP – H – 01

WATER SAMPLING EQUIPMENT DECONTAMINATION

Authorized for use: 1/17/2018
Revision 2

SCOPE	This SOP addresses decontamination of water sampling equipment. Procedures for both surface water and ground water sampling equipment are included.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-003: GW Sampling Submersible Peristaltic TRA1-005: Surface Water Sampling
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme Wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc Battery Acid HNO_3 Laboratory grade detergent
PPE REQUIRED	If on site items: 1-7 are required. If off site: items 3, 5, 6 and 7 are required. 1. Hard Hat 2. Safety Toe Boots (if surface water sampling felt (or comparable) soled waders a. (if boot foot waders ankle braces are required) 3. Safety Glasses 4. High Visibility Shirt/Vest 5. Clean Impervious Gloves 6. Long Sleeve Shirt 7. Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Laboratory grade detergent 5% Nitric acid Deionized/distilled/tap water Decontamination solution container
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Dan Cass Caleb Arbaugh Michael Picker
PROCEDURES	
PERISTALTIC PUMP DECONTAMINATION- IF PUMP HAS INTERNAL TUBING	1. Store decontamination solutions in clearly marked, dedicated containers. 2. Wear clean impervious gloves to avoid contamination of equipment/solutions. 3. Sampling in field with peristaltic pump with internal tubing: At each site place clean (new) tubing on the pump. Have pump situated so tubing does not touch the ground or other surfaces, such as the tailgate. If working off the tailgate, assure surface has been cleaned and situate pump at edge of tailgate so tubing does not touch the surface. 4. Attach filter to outlet end of tubing. 5. Rinse the end of inlet tubing with source water by pouring a small amount of water over tubing. 6. Place the decontaminated end of the pump tubing into the container of source water. 7. Pump source water through the new tubing with filter attached for at least 5 seconds after water begins to discharge from filter to thoroughly rinse line and filter before collecting filtered sample. 8. Dispose of decontamination solution to the ground surface unless the sampling/work plan states otherwise. 9. Sample preparation in lab: Add a generous quantity of 5% nitric acid to deionized water in a clean dedicated container. Internal tubing will be re-used for each site with adequate decontamination between all samples collected.

	10. After prepping initial sample, use a dedicated squirt bottle for deionized water, rinse the end of inlet tubing by squirting a small amount of water over tubing. 11. Place tubing end into decontamination solution and run decontamination solution through tubing. Run tap water in the sink during this step as a safety precaution. 12. Before collecting the filtered sample, attach filter to outlet end of tubing and rinse the tubing and filter with sample water to remove all traces of nitric acid. Repeat steps 9 through 11 for each time interval sample (3 Litres per each time collection) starting with last sample collected at the site and ending with first sample collected. 13. Remove and dispose of pump outlet tubing. 14. Cut a new length of pump outlet tubing in preparation for the next sample collection site. 15. If using peristaltic pump (modified Isco head) for ground water sampling, decontamination will be conducted using the technique described below in the Ground Water Sampling Pump Decontamination but the term tubing will replace pump.
FIELD DECONTAMINATION OF CHURN SPLITTER	1. Store decontamination solutions in clearly marked, dedicated containers 2. Wear clean impervious gloves to avoid contamination of equipment/solutions 3. Fill the churn splitter half-way full with deionized water and add approximately 1 cup of 5% HNO_3 to the water. 4. Swirl the water in the churn splitter, taking care to rinse all inside surfaces. Move the churn up and down. Dispense a portion of the water through the spigot, and pour the remaining water out of the top of the churn splitter. 5. Repeat steps 3 and 4 two times with deionized water only. 6. At the next site, rinse the churn splitter as described in steps 3 and 4 with source water.
OFFICE DECONTAMINATION OF CHURN SPLITTER	1. Store decontamination solutions in clearly marked, dedicated containers 2. Wear clean impervious gloves to avoid contamination of equipment/solutions 3. Fill the churn splitter half-way full with tap water and a small quantity (~1/8 teaspoon) of laboratory grade detergent 4. Swirl the water in the churn splitter, taking care to rinse all inside surfaces. Move the churn up and down. Use a clean brush with a handle (such as a bottle brush) to scrub inside seams and the spout. Use a small brush (toothbrush) to scrub the spigot. Dispense a portion of the water through the spigot, unscrew spigot and brush threads. Pour the remaining water out of the opening where the spigot was removed and the top of the churn splitter. When dispensing water out of the spigot, rinse the lid of the churn splitter. 5. Rinse the churn splitter three times with tap water. 6. Fill the churn splitter half-way full with deionized water and add approximately 1 cup of 5% HNO_3 to the water. 7. Swirl the water in the churn splitter, taking care to rinse all inside surfaces. Move the churn up and down. Dispense a portion of the water through the spigot, unscrew spigot and pour the remaining water out of the opening where the spigot was removed and the top of the churn splitter. When dispensing water out of the spigot, rinse the lid of the churn splitter. 8. Repeat steps 6 and 7 three times with deionized water only. 9. Cover the spigot with lab wrap or comparable material. Place the decontaminated churn splitter in two plastic bags which can be pulled shut. Store the churn splitter in a clean area until the next use.
GROUND WATER SAMPLING PUMP DECONTAMINATION	1. Store decontamination solutions in clearly marked, dedicated containers. 2. A tall, slender container is recommended for submersible pump decontamination. A plastic 2 liter volumetric cylinder works well. 3. Wear clean impervious gloves to avoid contamination of equipment/solutions. 4. Place a very small amount (one drop) of dilute laboratory grade detergent in the decontamination container. Review and follow all manufacture's instructions before dilution. 5. Fill the decontamination vessel with decontamination solution. For ground water monitoring, cleanliness of the source water along with the anticipated purge volume, can be considered when choosing a decontamination solution. a. If utilizing low flow sampling techniques, distilled or deionized water must be used. b. If utilizing the three casing volume technique, tap water can be used. i. If the total purge volume is small (< 3 gallons) and the source water is clean (expected to meet drinking water standards) distilled or deionized water shall be used for decontamination even when utilizing the three casing volume technique. 6. Ensure that the outlet end of the pump tubing is secured in the appropriate collection container before pumping commences. 7. Place pump (tubing if using modified ISCO head) into the decontamination solution. 8. Connect the pump to the power source and pump until the decontamination solution has purged through the entire tubing length. Add water to the decontamination vessel to ensure that the pump intake remains submerged. Disconnect the pump power source before the level of the decontamination solution is below the pump intake. 9. Pour any soapy water out of the decontamination vessel. Rinse the vessel to remove all detergent residue. Place the pump back in the vessel and pour decontamination water into the vessel to the top of the pump. Do not add detergent.

	10. Connect the pump to the power source and pump until the rinse water has purged through the entire tubing length. Add water to the decontamination vessel to ensure that the pump intake remains SUBMERGED. Disconnect the pump power source before the level of the decontamination solution is below the pump intake. Place pump and tubing into dedicated bucket for storage between sampling sites.
DOCUMENTATION	1. Note in the field book that equipment has been decontaminated

SOP – H – 02

DOWNLOADING TRANSDUCERS

Authorized for use: 02/02/2018
Revision 1

SCOPE	This SOP addresses downloading Solinst Levelloggers with a Bluetooth Solinst Leveloader App Interface. For transducers from other manufacturers, follow the manufacturer's directions. A water level measurement must always be recorded when downloading data.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-007: Download Transducers
STOP WORK TRIGGERS	1. Lightning (30 second rule) 2. Extreme Wind 3. Unsafe conditions 4. Inadequate PPE or equipment 5. Inability to access the work area safely 6. Defective equipment 7. Improper tools
MSDS	1. Arsenic 2. Cadmium 3. Copper 4. Lead 5. Mercury 6. Zinc 7. Manganese 8. Iron 9. White Lithium 10. PCB's 11. Wasp Killer
PPE REQUIRED	1. Hard Hat 2. Safety Toe Boots 3. Safety Glasses 4. High Visibility Shirt/Vest 5. Gloves 6. Long Sleeve Shirt 7. Long Trousers
P&IDs/Other Relevant Drawings	1. N/A
OTHER INSTRUCTIONS/SOPs	1. Other applicable TRA's/SOPs: Water Level Measurement, Read Staff Gage, Remove Manhole Cover
REQUIRED TOOLS	1. Levelloader 2. Water level tape (when applicable) 3. Decontamination equipment (when applicable) 4. Manhole Hook (MSD and sub drain sites) 5. Socket Wrench 6. Screw Driver 7. Hammer 8. Magnet to remove well cap (when applicable) 9. Metal Detector (when applicable)
Trained, Competent and Authorized Employees in this SOP	1. Tina Donovan 4. Janelle Garza 2. Alice Drew-Davies 5. Michael Picker 6. Daniel Cass

PROCEDURES

DOWNLOADING TRANSDUCERS WITH BLUETOOTH SOLINST LEVELOADER APP INTERFACE	1. Measure the depth to water in the well following SOP-GW-01_GW-LevelMeasurement when downloading transducers in wells. Record the water level on the field sheet and in the appropriate doForm. Projects: Butte Form: Butte – GW WLs r0. Read and record the water level of the staff gage according to SOP-SW-06_ReadSG when downloading surface water transducers. Record the water level on the field sheet and in the appropriate doForm. Projects: Butte Form: Butte – GW WLs r0. 2. If a direct read cable is deployed in the well or surface water, remove the cap from the direct read and screw the interface to the direct read cable. If a direct read is not deployed in the well or surface water, the transducer extension is attached by screwing it directly onto the direct read port. Remove the transducer from the well and remove the cap. Use a paper towel to dry the transducer off, so the water will not run into the adapter. Also, take the time to visually inspect the transducer and then line up the eyes and pinhole of the transducer with the eyes and pin of the transducer extension port and firmly, but gently, push the transducer into the App Interface. 3. Press the button on the interface until the light turns on. A green flashing light means the device is on. A blue flashing light means the Bluetooth is connected to your tablet. 4. Go into the settings of your tablet. Select the Bluetooth section. Your device will automatically be recognized. If there is only one Bluetooth interface device listed under "My Devices" and it is the serial number interface you possess, then no further action is required. If there are two serial devices listed under "My Devices" then you will have to remove the one that you are not using. Next to the status (Connected, Not Connected) of your bluetooth, there is a blue circle with an "i" inside. Press that and an option to "Forget This Device" will show up. Two different serial numbers of the same type of device will cause conflict with connection. 5. Go into the Solinst app. If the device disconnects while opening this app, you will have to toggle back to the Settings and manually connect the device again. Otherwise, you can either give the app a few seconds to recognize the transducer you are connected to, or you can drag down the left menu until you see a loading bar and a message to refresh the attempt to connect to the transducer. The connected transducer should show up at the top of the left menu. If you receive communication error messages, you may have to try downloading with a Leveloader (next section of the SOP). 6. Once connected to the transducer, click the "All Data" button below the picture of the transducer. If a download progress bar does not show up below the picture of the transducer, then simply click on the picture of the transducer and it should show up. Pay attention to make sure that it fully downloads (100%). Once the download is complete, the App will play a little tune. 7. After all data has downloaded, click the "Start/Stop/Edit" button below the picture of the transducer. In the detail view to the right, under the Datalogger Sampling Mode section, there is a red "Stop Now" button, press it. Again, the App will alert you when the action is complete with a tune and the "Stop Now" button will be un-highlighted. Under the Datalogger Status section, the Status should now say "Stopped" in red and the "Start Now" button will be highlighted. Press the "Start Now" button which appears in green. Again, the App Interface will play a little tune. Ensure that the Status says "Logging" in green before moving to the next well. 8. Disconnect from the transducer by removing the transducer from the extension port or unscrewing the direct read port. 9. To remove downloaded data from the tablet to the computer, you must have iTunes. 10. Connect the iPad to your laptop via USB. Open iTunes. A popup may ask for permission to connect the device, and you will have to follow prompts on the tablet and computer to complete this step. 11. In the top right, there is a tablet icon, click on it. In the left menu, select "File Sharing." Select Solinst in the Apps menu that shows up to the right. The downloaded files should show up to the right in the Solinst Documents menu. 12. Select all files and drag to the current month folder within \\woodardcurran.net\shared\Offices\Bozeman\BUTTE\TREC\ARCO\BPSOUGW\ContinualData\RawFiles

DOWNLOADING TRANSDUCERS WITH CORDED LEVELOADER

1. Measure the depth to water in the well following SOP-GW-01_GW-LevelMeasurement when downloading transducers in wells. Record the water level on the field sheet and in the appropriate doForm. Projects: Butte Form: Butte – GW WLs r0. Read and record the water level of the staff gage according to SOP-SW-06_ReadSG when downloading surface water transducers. Record the water level on the field sheet and in the appropriate doForm. Projects: Butte Form: Butte – GW WLs r0.
2. Turn Leveloader on by pressing the "ON" button in the top left corner of the device.
3. The Leveloader is emptied of all stored data prior to the next round of ground water levels. Check the "View Stored Data" by scrolling to it and pressing the button that points to the "OK" option on the screen. It will be empty if you are at your first download site. Check the last number in the log before downloading your current transducer; you may have to scroll down. Press the button that points to the "Menu" option on the screen.
4. Determine if there is a direct read cable or not, select the appropriate cord to plug into the Leveloader and connect the other end to the direct read or the transducer. A direct read requires the metal end and screws onto the metal direct read end of the transducer cord (the cap must be removed first). If attached to paracord, the transducer must be pulled up, the cap unscrewed, and the transducer needs to be screwed onto the cord with the eyes and pin by lining up correctly and attaching to the transducer. Make sure the connection is tight on both ends.
5. Select Connect to Logger. If "Check Cable Communication Error" pops up, you will either need to check your connections or look for an alternative download method. If this message appears for a direct read, you can try to pull the transducer up and connect to it with the other cord. If that still doesn't work, try downloading with a laptop (next section of the SOP).
6. If there are no connection issues, scroll down to Data from Logger and press the OK button. Data points will show up on the screen, press the Save Log button.
7. The download process will begin; it is best to pay close attention and wait for a "Download Complete!" message to ensure that all data was successfully downloaded. If you lose track of this, the screen will return to the Levelogger Menu if all data was successfully downloaded. A communication error message will flash if anything went wrong during data download, in which you will have to navigate to the menu to start over.
8. When Download is complete, press the Return button. Go back to View Stored Data to ensure that there is an additional log in the list from when it was checked prior to download. Return to the main menu. Once again select Connect to Logger and click okay. Scroll down using the down arrow until "Restart Levelogger" is displayed. Click OK. A message will be displayed instructing you to "Press both UP & DN to stop logger. Press the up and down arrow at the same time until a message appears "All data will be lost, continue?" Click ok and the device will display a message "Logger Started". Press Return, this will direct you to the home screen. You can now disconnect the transducer from the Levelloader.
9. Turn the Leveloader off between sites to save on battery by holding the ON button until the screen goes blank.
10. To remove downloaded data from the Leveloader to the computer, you must have the appropriate version of Solinst software downloaded to your laptop.
11. Connect the Leveloader to your laptop via the correct cord.
12. Turn the Leveloader on and scroll to the "Data to PC" option and press OK.
13. Open the Solinst software on your laptop. Go to the last tab at the top labeled "Leveloader." Press the top left icon of a Leveloader with a green arrow to a computer; this is "Retrieve Leveloader Settings."
14. Stored data should show in the left menu below. Press the icon with the arrow pointing down; this is "Download Data." A box will appear.
15. Open Windows Explore. Find the path to \\woodardcurran.net\shared\Offices\Bozeman\BUTTE\TREC\ARCO\BPSOUGW\ContinualData\RawFiles and the folder named the month and the year you have downloaded. Click on the path and save path as text. Paste the path you have copied as text into the line at the bottom of the box that appeared. Click okay.
16. When all files are transferred, another box will appear. Click finish.

DOWNLOADING TRANSDUCERS WITH A LAPTOP	1. Measure the depth to water in the well following SOP-GW-01_GW-LevelMeasurement when downloading transducers in wells. Record the water level on the field sheet and in the appropriate doForm. Read and record the water level of the staff gage according to SOP-SW-06_ReadSG when downloading surface water transducers. Record the water level on the field sheet and in the appropriate doForm. 2. Turn the laptop on and open the Solinst software. You can use either an optical reader (USB to "drop-in" transducer port) or the USB to direct read cord with transducer extension port. Select the appropriate cord for the connection type (direct read or transducer). Select the appropriate com port> 3. In the Solinst software on the laptop, make sure you are in the Datalogger Settings tab. Click the first icon in the top left, a transducer with a green arrow to a computer; this is "Retrieve Datalogger Settings." 4. Once connected, go to the Data Control tab. Click the first icon in the top left, a green arrow pointing down; this is "Download Data." Select "All Data" in the drop-down menu that pops up. If all three methods of connection fail, there may be an issue with the transducer; manufacturer maintenance or technical support should be sought and documented. 5. Once all data is downloaded, a graph will show the data. Go to File and select Save As. Make sure it is an XLE file and save it to the appropriate folder on the desktop. That data can then be transferred from the field laptop to an office laptop via thumb drive. If the field laptop has access to the server, it can be transferred to the current month folder within \\woodardcurran.net\shared\Offices\Bozeman\BUTTE\TREC\ARCO\BPSOUGW\ContinualData\RawFiles and the folder with the month and year.
DOCUMENTATION	At each site, record the date and time, depth to water or staff gage measurement, and any comments or notes that affect the water level in the appropriate site fields in the ground water levels Doform and printed sheet. If the transducer cannot be downloaded, document in the field book and seek maintenance or technical support.

SOP – H – 03
DOWNLOAD WEATHER STATION

Authorized for use: 1/17/2018
Revision 2

SCOPE	Multiple weather stations are downloaded (monthly) by TREC in the BPSOU. Data is downloaded directly to a laptop computer.
TRA(s) Referenced/ Reviewed	TRA-001: Common Hazards, driving, trailer, load, and unload. TRA-008: Download Sutron, ISCO, H350, WTX stations
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Laptop computer with Weatherlink 5.9.1 software loaded Laptop computer with a USB port USB to Mini-USB interface cable
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
OPEN HOUSING	1. Wearing work gloves, unlatch the stays, open the housing door.
DOWNLOADING DATA	1. Turn the laptop computer on 2. Connect laptop to weather station recorder using USB to Mini-USB interface cable. 3. Open Weatherlink 5.9.1 software. 4. Go to File, Open Station, highlight the station location you wish to download; click OK. 5. Next, choose Setup, Communications Port; ensure that Communications is set to **USB**. Sometimes, you might have to adjust the Com Port or Baud Rate to get the download, but leave the Communications option set to USB. 6. Go to File, Download; confirm by clicking OK. 7. After the download is complete, choose File, View Log, and confirm the correct data were downloaded by scanning the Date/Time. 8. Finally, Choose Browse, Export Records, highlight desired dates, and click OK. 9. Choose a name (ex. BSB-Shop_121914) and location to save your exported data; click Save. 10. X out of Weatherlink, or use File, Exit. 11. Disconnect the communication cable. 12. Store the laptop.
CLOSE HOUSING	1. Wearing work gloves, close the door of the weather station housing.
DOCUMENTATION	1. In the field book, record the arrival date/time and the site name. Document that data was downloaded from the recorder and the name and location of the exported file.

SOP – H – 05
Calibrate YSI Professional Plus Multi-Meter

Authorized for use: 01/17/17 **Revision 1**	
SCOPE	This SOP addresses the manual calibration of YSI Professional Plus Multi-Meter.
TRA(s) Referenced/ Reviewed	
STOP WORK TRIGGERS	Unsafe conditions Inadequate PPE or equipment Inability to access the work area safely Defective equipment Improper tools
MSDS	1413 µS/cm Conductivity Solution 447 µS/cm Conductivity Solution Buffer Solution pH 7.00 Buffer Solution pH 4.01 Buffer Solution pH 10.02 ORP Standard Solution
PPE REQUIRED	Closed-toe shoes Safety glasses Gloves (nitrile, impervious) Long sleeve shirt Long trousers
OTHER INSTRUCTIONS/SOPs	Refer to product manual for troubleshooting, maintenance, and further information.
REQUIRED TOOLS	Philips screwdriver to change batteries, if low (3 C Batteries)
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
Dissolved Oxygen (DO %)	1. Turn the meter ON. 2. Make sure that there is a good DO membrane with fresh electrolyte solution (there should be no air bubbles or wrinkles, also the tip should not be corroded). 3. Blot excess water from the DO probe and fill the calibration/storage cup with a small amount of water (the longest probe is the metal tip of the temperature/conductivity probe – it should be completely above the water surface). 4. Lightly screw on the calibration/storage cup, giving it two turns. 5. Press CAL, use the arrows to highlight DO (%) and press ENTER. Allow the DO% reading to stabilize (at minimum ten minutes, the numbers might bounce back and forth but you won't see a trend.) 6. From the calibration screen, record the barometer value. 7. After stabilization, press ENTER to accept calibration. Record the final calibration value (%) from the meter display.
pH (SU)	8. Always starting with neutral (pH 7.00), pour buffer solution rinse into the calibration/storage cup. Tighten cup and gently shake probes to rinse. Discard the rinse solution in the sink. 9. Fill cup with fresh buffer solution (from the gallon bottles). All of the probes should be completely covered, including the conductivity orifice. 10. Press CAL, use the arrows to highlight pH (SU) and press ENTER. Allow the pH reading to stabilize by monitoring both the pH (SU) and voltage (mV) values (viewed in the calibration screen). Again, the numbers might bounce back and forth but you won't see a trend. 11. For pH, the temperature adjusted calibration value will automatically populate so you won't have to manually change it. Here is a calibration table showing what the temperature adjusted calibration values and voltage range should look like:

Calibration Temperature (°C)	pH 7.00 voltage range (0 mV to 50 mV)	pH 4.00 voltage range (+165 to +180 from buffer 7.)	pH 10.00 voltage range (-165 to -180 from buffer 7.)
10	7.07	4.00	10.19
15	7.05	4.00	10.12
20	7.02	4.00	10.06
25	7.00	4.00	10.00

12. After stabilization, record initial value (SU) and temperature (°C) from meter display. Then, use arrows to highlight *accept calibration value* and press ENTER (only once!) At the very bottom of the calibration screen, you should see "Ready for Point 2". Record the final calibration value (SU). Note: for Point 1, there is typically no final value displayed for your first point (pH 7.) as you need two points to complete the line.
13. Repeat Steps 7-11 as necessary (pH 7. and 4. for groundwater and pH 7. and 10. for surface water.) Use a three point calibration (pH 7., 4., and 10.) if the meter has been in long term storage or has been recently maintained (replacement or cleaning of probes), etc.
14. When you have accepted the final calibration value (second, or third point depending on what you are calibrating for) press CAL to complete pH calibration.

SC (µS/cm)

15. Pour conductivity solution rinse (447 µS/cm for surface water, and 1413 µS/cm for groundwater) into the calibration/storage cup. Tighten cup and gently shake probes to rinse. Discard the rinse solution in the sink.
16. Fill cup with fresh conductivity solution (from the gallon bottles). All of the probes should be completely covered, including the conductivity orifice.
17. Press CAL, use the arrows to highlight conductivity, then highlight specific conductance, press ENTER, then highlight µS/cm and press ENTER. Allow the SC reading to stabilize.
18. For SC, the default calibration value must be changed. Use the arrow keys to scroll up to the calibration value (it should read the same as the meter), press ENTER to edit, and use the arrow keys to backspace and edit the calibration value to the value of standard which you are using. Press ENTER to take you back to the calibration screen.
19. After stabilization, record the initial calibration value (µS/cm) and temperature (°C) from meter display. Hit ENTER to accept value.
20. Press CAL to complete and record the final calibration value.

ORP (mV) (Typically only calibrated for groundwater monitoring)

21. Pour ORP rinse solution into the calibration/storage cup. Tighten cup and gently shake probes to rinse. Discard the rinse solution into the sink.
22. Fill cup with fresh ORP solution (from the brown liter bottle). All of the probes should be completely covered, including the conductivity orifice.
23. Press CAL, use the arrows to highlight ORP, then ENTER.
24. For ORP, the default calibration value must be changed. If the standard used is Geotech 220 mV +/-5 mV at 25°C, use the following table to look up the ORP standard value to the nearest 5°C.

Temperature (°C)	Potential (mV)
0	237
5	232
10	230
15	227
20	223
25	220
30	216

25. Use the arrow keys to scroll up to the calibration value, press ENTER to edit, and use the arrow keys to backspace and edit the calibration value to the value of standard which you are using. Press ENTER to take you back to the calibration screen.
26. After stabilization, record the initial calibration value (mV) and temperature (°C) from meter display.
27. Press CAL to complete and record the final calibration value.

DOCUMENTATION

1. In the field book you will log the following fields: calibration standard (value and manufacturer for ORP standard as well as expiration date), initial value (except for DO), final value, and temperature (°C). The field book information is also submitted electronically via a calibration DoForm, under the correct project.

REPORTING

1. Follow **Processing Steps for the appropriate project(s) located at** https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20GWL%20Processing%20Steps.aspx. Download appropriate doForms by following **DoForms Online Download Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/DoForms%20Online%20Download%20Steps.aspx.
2. Ensure that all files are complete and organized as instructed in **Butte – GWL File Organization Details** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20GWL%20File%20Organization%20Details.aspx.

SOP –S – 01
Bump Testing The VENTIS MX4 Gas Monitor

Authorized for use: 01/17/2018 **Revision 2**	
SCOPE	This SOP addresses bump testing the VENTIS MX4 gas monitor. The gas monitor needs to be bump tested before use each day.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-016: Calibrate-Bump Test
STOP WORK TRIGGERS	Unsafe conditions Inadequate PPE or equipment
MSDS	Non-Flammable Gas Mixture (CalGaz)
PPE REQUIRED	Safety Glasses Safety Toe Boots
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Ventis MX4 Portable Multi-gas Monitor Positive flow regulator Calibration tubing with t-fitting Gas cylinder
Trained, Competent and Authorized Employees in this SOP	Nicole Santifer Dan Cass Jackie Dudding Janelle Garza Alice Drew-Davies Tina Donovan Caleb Arbaugh Michael Picker
PROCEDURES	
DOWNLOADING TRANSDUCERS IN SURFACE WATER BODIES	1. Attach the regulator with tubing attached to the gas cylinder and turn clockwise to tighten, Do Not attach the tubing to the monitor at this time. 2. Turn on the gas monitor by pressing the ON button until the screen turns on 3. Press the ON button until ø(zero) is displayed 4. Press the ENTER button, a clock will appear at the top of screen, when it is finished it will beep and return to the home screen 5. Press ON button until BT is displayed 6. Press the ENTER button 7. Connect the tubing to the pump inlet 8. Turn the regulator knob counterclockwise to start the flow of gas (clock icon flashes to indicate the test is in-progress) 9. Verify that the monitor is beeping and vibrating in response to the gas 10. If the bump test passes a P will be displayed for all four sensors, If it fails a b F will display and the monitor will need to go through a full calibration. 11. Turn the regulator knob clockwise to turn off the flow of gas immediately after the test is complete. 12. If the monitor passes the bump test it will continue to alarm until the gas level falls under the low alarm level. 13. Press the ON button until the peak reading screen displays (looks like a mountain with an arrow in top right corner) 14. Press the ENTER button to clear the peak readings 15. Zero the monitor in fresh air (not in the area you bump tested in) by following steps 3 and 4 above
DOCUMENTATION	1. Document bump test and results in field book.

SOP – SW – 01

MANUALLY COLLECT SURFACE WATER SAMPLES

Authorized for use: 1/17/2018
Revision 7

SCOPE	This SOP addresses the manual collection of surface water samples.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards, Driving, Trailer, Load/Unload TRA1-005: Surface Water Sampling TRA1-028: SS-07
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Water depth greater than three feet and life jacket, throw ring, and rescue skiff or railing are not on hand Inability to access the work area safely Defective equipment
MSDS (attach)	Arsenic Cadmium Copper Lead Mercury Zinc HCl HNO_3 H_2SO_4 pH buffers (7.00 s.u., 10.00 s.u.) Conductivity Standard (<3 ms/cm) EDTA
PPE REQUIRED	Hard hat Waders If using boot foot waders, ankle support required. Safety glasses High visibility shirt or vest Gloves (leather, impervious, and shoulder length gloves (calving gloves)) Long-sleeve shirt Long trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Sample bottles Filters Peristaltic Pump and appropriate cords Appropriate 12-V battery Tubing Deionized water for decontamination Churn Splitter YSI Pro Plus meter
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew Davies Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
READ and RECORD STAFF GAGE	1. Read and record staff gage according to SOP-SW-06_ReadSG.
SURFACE WATER SAMPLE COLLECTION	1. Surface water samples are collected by submerging a sample container into the water body, or in the case of the dissolved portion of a sample, pumping source water through a 0.45-micrometer filter and into a sample container. If sample bottles are pre-preserved, the non-acidified general chemistry bottle is used to collect all sample aliquots. The sample is then transferred from the non-acidified bottle to the acidified

bottles. This is repeated until all bottles are filled. Samples can be collected by crossing a stream or by standing in one spot and collecting the entire sample in that one spot. Always wear clean impervious gloves when collecting samples to protect both skin and sample integrity. Shoulder length gloves are available when necessary and should be worn on top of the inner impervious nitrile gloves. Change gloves between samples to avoid cross-contamination.

2. Surface water sampling requires the buddy system. At least two people must be present for surface water sampling to take place.
3. Surface water samples can be collected by entering the stream or from the side of the stream, depending on the stream reach. For streams greater than three feet in width, the equal width increment method will be used. For streams less than three feet wide, or for end-of-pipe sampling, a sample can be collected from one point in the stream. When sampling stream reaches that are not completely mixed, a churn splitter will be used to collect the sample. When sampling water bodies that are difficult to access by hand, a Water Thief (long handled sampling device) should be used.
4. When entering a stream, always face upstream. Cross a stream stepping sideways. Do not rush. Make sure to enter below the sampling point.
5. To collect the sample, don the appropriate impervious gloves, submerge the sample container and collect a small portion of water for rinsing the container. Replace the container lid and invert the container, ensuring that the water within the container has washed across all surfaces of the container. Discard the rinse water downstream of the point at which the sample is to be collected. If sample containers are not certified, the rinse process should be carried out three times. Certified containers require only one rinse. **Do not rinse pre-acidified bottles.** Once the container has been rinsed, submerge the sample container to fill it using the appropriate method, equal width increments or grab. Take care that sediment is not stirred up off the stream bed during sample collection. If using a Water Thief, thoroughly rinse it three times with source water. **Use care that the stream bed is not contacted**. Transfer the sample from the rinsed Water Thief into the sample container.
6. To sample by the grab method, stand in one position and fill the sample bottle(s).
7. To sample by the equal width increment, start at the right edge of water (REW), collect a small portion of water into the sample container, **avoid touching the bottom of the streambed so that sediment is not stirred up during sample collection**, step towards the left side of the stream, and collect a second portion of water into the sample container. Continue in this manner until the sample container is filled and the left edge of water (LEW) is reached. Use common sense dividing the stream reach into equal increments. Narrower streams will require fewer increments, wider streams, more increments.
8. Bottle and preservations requirements for creek baseflow samples are as follows:
   - Total Metals 250 mL plastic, HNO_3 preserved
   - Dissolved Metals 250 mL plastic, filtered, HNO_3 preserved
   - NO_2/NO_3 250 mL plastic, H_2SO_4 preserved
   - Dissolved Organic Carbon 250 mL amber glass, filtered, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01)
   - TDS, TSS, Alkalinity, SO_4 1000 mL plastic, no preservative, zero headspace
   - TKN 250 mL plastic, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01)
   - NH_3, 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01)
   - Total Phosphorous 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01)
9. The dissolved metals and the DOC sample requires filtration. Collect the filtered portion out of the non-preserved container(s) which have been previously filled by the equal width increment method. Stream water will be utilized to rinse the outside of the pump tubing as well as the inside. Place a short (1 foot) piece of tubing on the pump and place a filter on the outlet end of the tubing. For the outside rinse, pour a small amount of water, from the general chemistry bottle, over the inlet tubing end. Submerge the inlet tubing into the bottle and pump for approximately 5 seconds after the water begins to flow through the filter. The sample is collected after the brief decontamination of the tubing and filter. If collecting a grab sample, the filtered aliquot can be pumped directly from the stream, if it is convenient to do so.
10. To sample with a churn splitter, use the non-acidified container to collect the sample water. Before collecting the sample, rinse the decontaminated churn splitter with sample water by pouring several bottles of source water into the churn splitter. Swirl the water in the churn splitter, covering all surfaces, and then empty the churn splitter of the rinse water by dispensing some through the spigot and pouring the remaining water out of the top of the churn splitter. Then using the equal width increment method, collect sample water into a non-preserved sample bottle and transfer the water into the churn splitter by pouring it in the top. Be sure to collect adequate water to fill all sample aliquots as well as to rinse any tubing used for filtered aliquots. Once adequate water has been poured into the churn splitter, begin "churning" the water. Slowly raise and lower the churn by the handle, taking care to not break the water surface. While the water is being churned, the samples should be dispensed out of the spigot. Collect any total metals aliquot first, once an initial aliquot has been dispensed, any total dissolved solids (TDS)/total suspended solids (TSS) aliquot can be dispensed. The TDS/TSS aliquot should never be the first sample dispensed. Lastly, collect

	any dissolved/filtered aliquots. To collect the filtered aliqot(s), rinse the inlet end of tubing and place in the churn splitter. Churning is no longer necessary. Pump the sample out of the churn splitter, through the filter, into the sample bottle. 11. In cases that sample portions do not require preservation, no air space should be left in the sample container. In cases that sample portions do need preservation and bottles are not pre-acidified, minimal air space should be left in the sample container. If pre-acidified bottles are in use, an air space is not necessary; however, take care to not overfill bottles so that preservative is not lost. 12. If not using pre-acidified bottles, return to vehicle for sample preservation (when applicable). If not practical to return to vehicle, find a level, clean working surface. Set all sample portions on the working surface and separate by type of preservative required. The outer shoulder length gloves can be removed, but inner nitrile or impervious gloves must be worn. Be certain that safety glasses are on. Do not handle preservatives or empty preservative vials without protective gloves or safety glasses. Set appropriate preservative next to appropriate sample portion. Remove lid of sample container and add the appropriate type and amount of preservative to the sample. Replace lid and tighten securely. Discard empty preservative vials. Remove protective gloves. 13. Label all samples following the instructions in #2 in the Documentation section below. 14. Place samples in cooler containing ice. 15. Discard tubing and filter after each site. 16. Move on to the next site until all sites are completed.
FIELD PARAMETER MEASUREMENT	1. Prior to base flow monitoring, open a "Butte-BF_Transformer" file located in Z:\Butte\TREC\ARCO\BPSOUSW\BaseFlow\SampleCollectionRecords. Follow **Butte – BF Processing Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20Processing%20Steps.aspx. 2. Field parameter meters shall be calibrated each day of use, according to manufacturer's instructions. If manufacturer recommends a differing calibration frequency, that frequency should be used. Meters shall be calibrated prior to leaving the office and all parameters shall be entered into a calibration doForm on the iPad that will be used to record sampling field data. Project: Butte Form: Butte-Rocker – Equip Calibr r1. 3. To measure parameters, remove plastic cover from bulkhead of meter. Replace with metal cover containing holes to allow water to enter meter but probes are protected. Immerse the meter directly in the stream placing meter perpendicular to flow. Once parameters have stabilized, record the parameters in the latest version of base flow sampling doForm. Example: (Project: Butte Form: Butte – BF Smpl Clctn r0). 4. If meter type does not allow for immersion in the stream, collect stream water into a small container. Immerse the probes in the container, swirling the probes while waiting for parameters to stabilize. Once the parameters are stable, record the parameters.
DOCUMENTATION	1. In the field book, at the beginning of the sampling job, record date, personnel involved, safety topics for the day, and weather conditions. Also indicate which iPad will be used to for the day so that records can be easily found if necessary. Complete a "Butte – BF Smpl Clctn r0" doForm on the iPad that will be used to record sampling field data. Follow **Butte – BF I-Pad Steps -smpl** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20I-Pad%20Steps%20-smpl.aspx. Record any unusual circumstances in the notes of the doForm as well as the field book. At the end of the day record any deviations from the Work Plan/Sampling Plan. 2. Each sample shall be clearly labeled in waterproof ink with a unique sample ID, sample date, sample time, sample analysis, sample preparation (i.e. filtered, preservative used), and sampler's initials.
REPORTING	1. When back at the office, download the sampling doForms and complete the **Butte – BF Processing Steps**. Follow **DoForms Online Download Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/DoForms%20Online%20Download%20Steps.aspx. 2. Once sample files are imported, you may complete the COC tabs and check the samples against the chain prior to shipping the samples. 3. Ensure that all files are complete and organized as instructed in **Butte – BF File Organization Details** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20File%20Organization%20Details.aspx.

SOP – SW – 02
FLOW MEASUREMENT IN WADABLE STREAMS

Authorized for use: 01/17/2018 Revision 6	
SCOPE	This SOP addresses the manual measurement of surface water flows in streams which can be waded, with a Marsh McBirney flow meter.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards, Driving, Trailer, Load/Unload TRA1-006: Measure Stream Flow TRA1-028: SS-07
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Water depth greater than three feet and life jacket, throw ring, and rescue skiff or railing are not on hand Inability to access the work area safely Defective equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCP
PPE REQUIRED	Hard hat Waders If using boot foot waders, ankle braces Safety glasses High visibility shirt or vest Gloves Long-sleeve shirt Long trousers
REQUIRED TOOLS	Wading rod Flow meter Cloth measuring tape marked in 0.1 foot increments Spring clamps iPad Clip board Calculator
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
STREAM FLOW MEASUREMENT	1. Stream flow is measured by dividing a channel cross section into even increments, and measuring velocity at 60% of the total depth of each increment. (At depths greater than 2.5 feet, velocity is measured at 20% and 80% of the depth, and the average of the two measurements is used to calculate flow). Velocity and depth is measured at each increment. Flow in any one increment should not exceed five percent of the total cross section stream flow. The stream should be divided into enough increments so that this criterion is met. 2. Find an appropriate site for measuring flow. Flow should be measured on a straight stream section, not on a bend. If possible, use a cross section of uniform depth and velocity. Avoid areas of excessive in-stream vegetation. If not possible to avoid in-stream vegetation, remove the vegetation prior to commencing flow measurements. Once measurements have begun, nothing should be removed from or added to the stream bed. 3. The flow meter averaging period should be set between 20 and 40 seconds (30 seconds is preferable). A lower averaging period can be used in storm flow situations, but never reduce the averaging period below ten seconds. In base flow situations, never reduce the averaging period below 20 seconds. 4. Confirm, by looking at the display, that the measurements are being recorded in FT/S. If not,

	press and hold ON/C button and OFF button at the same time until the units change. 5. String a cloth tape measure across the stream, so that the tape is perpendicular to flow. 6. If a staff gage is present, read and record the staff gage level at the commencement of flow measurements. Record the time. 7. Proceed to measure flow by measuring and recording distance from the REW, velocity, and depth at the mid-section of each increment. 8. Begin flow measurements at the right edge of water (REW) (REW is the right-hand bank when facing downstream). 9. Set the wading rod at the starting point on the REW with the bulb pointing upstream, observe and call out the distance on the tape that the rod is located at; observe and call out the depth (depth is determined by using the Depth Gauge Rod, one line is a 0.1-foot measurement, two lines indicates the 0.5-foot measurement, and three lines is the 1.0-foot measurement) then set the wading rod to the proper depth. This is accomplished by depressing the sliding rod lock and sliding the rod with the bulb on it until the line on the rod matches up with the observed depth. To obtain a velocity measurement, press the ON/C button. A bar will appear on the bottom of the display screen next to the word period. When the bar reaches the small sideway triangle the period is complete, and the average velocity measurement will appear in the display window. Call out the velocity displayed. Move to the next increment and repeat. 10. If depth is greater than 2.5 feet, step 9 is followed, but velocity is measured at 20% of the depth and 80% of the depth (two-point method). For example, depth is 3 feet. Set the wading rod to 0.6 feet, make a velocity measurement over the averaging period, call out that measurement at the end of the averaging period. Staying at the same distance, set the wading rod to 2.4 feet (this is accomplished by moving the sliding rod up until the 2 on the rod is matched with the 4 on the handle), make a velocity measurement over the averaging period, call out the velocity at the end of that period. The velocity for that distance is the average of the 20% depth velocity and the 80% depth velocity. In storm flow situations, do not use the two-point method, but the 60% method. Stage changes so quickly in storm flow situations that more accuracy will be lost making two velocity measurements than making only one. 11. If a staff gage is present, read and record the staff gage level at the completion of flow measurements. Record the time. 12. Remove measuring tape from cross section. 13. Exit stream. 14. Move on to next site.
DOCUMENTATION	1. Prior to base flow monitoring, open a "Butte-BF_Transformer" file located in Z:\Butte\TREC\ARCO\BPSOUSW\BaseFlow\SampleCollectionRecords. Follow **Butte – BF Processing Steps** located at https://woodardcuran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20Processing%20Steps.aspx. 2. In the field book, at the beginning of the sampling job, record date, personnel involved, safety topics for the day, and weather conditions. Also indicate which iPad will be used to for the day so that records can be easily found if necessary. Complete a "Butte – BF Dschrg Msrmnts r0" doForm on the iPad that will be used to record discharge measurement data. Follow **Butte – BF I-Pad Steps –dschrg** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20I-Pad%20Steps%20-dschrg.aspx. Record any unusual circumstances in the notes of the doForm as well as the field book. At the end of the day record any deviations from the Work Plan/Sampling Plan. 3. Fill out a base flow discharge measurement doForm for each site. 4. Navigate to the dropbox account and open the 1_StreamFlowExcelToolbyDRH – Butte.xltm. Duplicate the file and rename with the convention streamflow_YYYY-MM-DD.xlsx. Navigate through each worksheet tab and record measurements, saving the file after each site worksheet tab is completed.
REPORTING	1. When back at the office, download the discharge measurement doForms and complete the **Butte – BF Processing Steps.** Follow **DoForms Online Download Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/DoForms%20Online%20Download%20Steps.aspx. Once discharge files are imported, you may complete the field records report in the Instructions tab of your BF excel macro file. 2. Download and save the dropbox excel file that discharge measurements were recorded in to Z>Butte>TREC>ARCO>LAO>SW>Base Flow>2015. Also save the file as a PDF. 3. Ensure that all files are complete and organized as instructed in **Butte – BF File Organization Details** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20BF%20File%20Organization%20Details.aspx.

SOP – SW – 03

CHANGE H350 STAGE RECORDER DATA CARD

Authorized for use: 01/22/18
Revision 2

SCOPE	Data cards are changed on a weekly or monthly basis, depending on the site. Data is retrieved from continual recorders at SS-CB9, SS-05, and SS-05A using the procedures described in this SOP.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-008: SG Readings Download Sutron ISCO H350 Weather Station
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots/waders Ankle braces if wearing boot foot waders Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Data cards Keys
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
OPEN H350 HOUSING	1. Wearing work gloves, unlock the lock on the housing, remove the lock, and open the housing door. Store the lock inside the housing.
CHANGE DATA CARD	1. Turn on the H350 interface box. 2. Using the down arrow, key down to Change Data Card, hit enter, and follow the prompts on the display. When the new data card is inserted, a FORMAT CARD? Prompt will appear. To format the card, hit enter. Otherwise hit the down arrow. Only format the card after it has been downloaded. 3. Store the data card that you removed from the logger in the plastic cover provided, and then insert the card into the container of all data cards. Carry these cards in a secure area (pocket that it will not fall out of, zippered bag) 4. On the H350 interface, hit escape to go back to the main menu 5. Read the staff gage to the nearest 0.01 foot. (See SOP: SOP-SW-06) 6. Look at the bubbler orifice in the creek, if it is covered with debris, remove debris before starting step 7. 7. Read the stage level on the H350 recorder. If the recorder stage is not in agreement with the staff gage, purge the bubbler system as directed below. 8. After the purge is complete, hit the enter key and the H350 will make a measurement. If the

	recorder stage is still not in agreement with the observed stage, adjust the recorder stage as directed below.
FORMATTING DATA CARD	1. All data will be erased when cards are formatted. Never format a data card until all data has been retrieved from the card. 2. Data cards should be reformatted every three to four months. If problems occur retrieving data from a card, the card should be reformatted **AFTER** the data has been retrieved. 3. Using the down arrow, key down to Change Data Card, hit enter, and follow the prompts on the display. When the new data card is inserted, a FORMAT CARD? Prompt will appear. To format the card, hit enter. Otherwise hit the down arrow. Only format the card after it has been downloaded.
CHECKING LOGGING PARAMETERS	1. Logging parameters should be checked and corrected if necessary at least one time per month. 2. From the main menu, use the down arrows to go to the Logging Parameters menu, hit enter at the Logging Parameters prompt. Use the down arrow to go through the parameters and left/right/up/down arrows to make changes to the logging parameters. Ensure that all logging parameters are correct (Date, Time, Start time, File Name, Logging ON). If a change is made to the time, ensure that the start time is correct. For example, if the current time is 1316, and the recorder time is 1312, enter the correct time (1316). The start time must be updated from 1315 to 1330 or logging will not begin until the following day at 1315. Make sure the Logging is ON. Escape out to the main menu
ADJUST RECORDER STAGE	1. From the main menu, use the down arrows to go to the Edit Coefficients menu. Hit enter. Use the down arrow to go to the EDIT STAGE SCALAR menu. Hit enter and the recorder stage will appear. Use the left, right, up, and down arrows to change the scalar to the observed stage. It is important to enter an accurate stage reading. Once the recorder stage has changed, use the escape key to go out to the main menu,
PURGING BUBBLER SYSTEM	1. The bubbler system should be purged at least once a month and more often in times of high flows or in areas that are prone to sedimentation. 2. Open the compressor system housing which is located directly below the H350 interface housing. 3. Locate the circuit card (against the left-hand housing wall). 4. Towards the front and middle of the circuit card, find the small, white button. Press the button. The compressor will purge. 5. Watch the pressure gage, it should increase to 40 psi as pressure builds, then drop steadily to 0 psi as air is blown out of the bubbler tubing. After dropping to zero, the system should re-pressure slightly. If the pressure does not drop steadily repeat the purge process two to three times. If the pressure still fails to drop steadily, the tubing is plugged and it will be necessary to blow the tubing out with compressed nitrogen. Refer to the appropriate SOP for that process. 6. Once the purge process is complete, close and latch the compressor housing door. 7. If the bubbler outlet is encased in ice, there is no need to purge the system. The system will read an ice pressure until the ice melts.
DEPARTING FROM THE H350 STAGE RECORDER	1. Turn off the H350 interface. Close and latch the doors of the H350 interface and compressor housing. Wearing gloves, close and lock the housing door of the H350 system.
DOCUMENTATION	1. In the field book, record the arrival time, the site name, the staff gage level, and the level on the recording system. Record all tasks performed. At a minimum, the following should be recorded: Arrive at site-include arrival time. Observed staff gage level, level on H350 Any edits made to the stage scalar Change data card-indicate if new card is formatted on site. Check logging parameters Date ok/corrected Time ok/corrected Start time ok/corrected Logging on Purge system

SOP – SW – 04

DOWNLOAD ISCO STAGE RECORDER (4200 or 2150 models)

Authorized for use: 01/22/18
Revision 2

SCOPE	ISCO stage recorders (flow meters) are downloaded monthly, or more often during wet weather season. Data is downloaded directly to a laptop computer.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-008: SG Readings Download Sutron ISCO H350 Weather Station
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme Wind Unsafe conditions Inadequate PPE or equipment Defective equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Laptop computer with ISCO Flowlink 5.1 software loaded ISCO USB-6 pin communication cable (communication cable with threads for ISCO 4200s and communication cable with square tab lock for ISCO 2150s) Keys
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
OPEN ISCO HOUSING	1. Wearing work gloves, unlock the metal housing. If possible, visually inspect the lock area prior to placing hands in the area. Insects are often within the lock area. Remove the lock(s) from hasp and store it/them on the handles of the metal housing. 2. Two types of ISCO storage boxes are present at the BPSOU. On one type, the lids are secured with two hasps and locks and the lids lift completely off the storage box. On the second type, the lid is hinged and is secured with one hasp and lock. If at the first type of box, lift the lid off the metal housing and set it on the ground, or against a sturdy structure. Place the lid clear of the immediate work area. If at the second type of box, lift the lid up, and let rest on chains, if no chains are present, lower it to the ground or use the wire attached to the willows or another structure to secure the lid open. Do not let the lid drop to the ground. Be careful to not set the lid on cables or lines.

DOWNLOAD DATA	1. Turn the laptop computer on. 2. Lift the flow meter out of the storage box and set it in a stable spot (on top of the sampler or on the corner of the storage box so that it is resting on two walls of the box). 3. Connect the USB port end of the interface cable to the USB port on the laptop. Connect the 6-pin end of the cable to the interrogation port on the flow meter. 4. Open Flowlink 5.1 software. 5. A Connect window will appear. Select a com port from dropdown window. If you leave on default, it will not connect. After selecting com port, click on the picture of the type of logger you're interrogating (ie. 4200 series for 4230, or 2100 series for 2150). 6. On the drop-down menu, go to Actions/Retrieve Data, click the retrieve data button, or press F8. Wait for the data to be downloaded. 7. After data has been downloaded successfully, look to the left on the computer screen. Click on Graphs and Tables to expand menu. Right click on (either 2150 or 4200) 4 weeks and select Copy to DEFAULT. Return to center of screen. Click DEFAULT Graph button. The graph will be visible. Check the graph for the data you are looking to retrieve. If it is not visible in the screen or if part of it is missing, look at the header and find the small magnifying glass with the negative sign. Using this allows you to expand the dates of the data you are viewing. Once desired data is present in the default graph, export it to the computer. 8. On the drop-down menu, go to File and select Export from the list. An export box will appear. Click the Select button, Desktop, and "Creek Downloads" for creek sites and "Diagnostic Downloads" for diagnostic sites. If there is not a folder for the month you are downloading to, create one. Example: 2018-01. Within the folder, save the file using the site name and date it is downloaded. Example: SS-05A_012218. Click Save. 9. Upon returning to the export box, click export. A message will appear "The data was exported successfully", click okay. Click close. 10. Click to close Default graph. A message will appear, Save changes to DEFAULT – SS-05A? Select no. 11. On the drop-down menu, go to File and choose Close, select the Disconnect button, or press F2 to close the program. 12. Disconnect the communication cable. 13. Separate the communication cable from the laptop. Store the laptop computer and communication cable. 14. Read and record the staff gage to the nearest 0.01 foot, following the SOP for reading staff gages. 15. Check the end of the bubbler in the water, if debris is visible, remove. 16. Read and record the stage on the ISCO flow meter. 17. If the flow meter is not in agreement with the staff gage, open the front of the ISCO flow meter. 18. Using the keys on the front of the flow meter, press the manual purge button. Give the unit ample time to purge and return the air to equilibrium before proceeding to next step. 19. If the stage is not within 0.02' of the observed stage, it must be adjusted. Using the keys on the front of the flow meter, press Go To Program Step, then press 3. 20. This brings up the Parameter to Adjust Menu, use the right arrow key to choose Level. In the Level Menu, enter the correct stage using the numbers on the key board and hit enter. Use the Exit Program key to get to the main display. 21. Check the date and time on the flowmeter, and make any necessary corrections. 22. To correct date or time, press the ENTER PROGRAM STEP key. Use the arrow key and go to Setup, press ENTER PROGRAM STEP. Choose Clock, press ENTER PROGRAM STEP. The program steps through year, month, day, hour, and minute. Adjust any value as needed with the keypad numbers. After each adjustment, or to step to the next choice, press the ENTER PROGRAM STEP key. Continue pressing the ENTER PROGRAM STEP key until returned to the Setup menu. Press EXIT PROGRAM to return to the main screen. 23. Close and latch the door of the flow meter. 24. Replace the flow meter in the storage box. If there is water in the bottom of the box do not set directly on the bottom. This protects the meter from becoming wet in case sampler problems occur. Ensure that all tubing is not kinked or lying underneath the flow meter or sampler. 25. When all recorders have been downloaded, exit the Flowlink program by going to the drop-down menu and choosing File, Exit.
CLOSING ISCO HOUSING	1. Wearing work gloves, replace the lid on the housing box. 2. Lock housing box (if applicable).

	3. Proceed to next site.
DOCUMENTATION	1. In the field book, record the arrival time, the site name, the staff gage level, and the level on the recording system. Document that data was downloaded from the recorder and any adjustments made to the recorder level, date, or time.

SOP – SW – 05
DOWNLOAD SUTRON STAGE RECORDER

Authorized for use: 01/21/2018
Revision 2

SCOPE	There is one Sutron stage recorder present in the BPSOU. It is downloaded monthly, or more often during wet weather season. Data is downloaded directly to a laptop computer.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-008: SG Readings Download Sutron ISCO H350 Weather Station
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Laptop computer with Xterm software loaded Laptop computer with a serial port, or a USB/serial port adaptor Laptop/recorder interface cable (stored in Sutron housing) Screwdriver Keys
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker

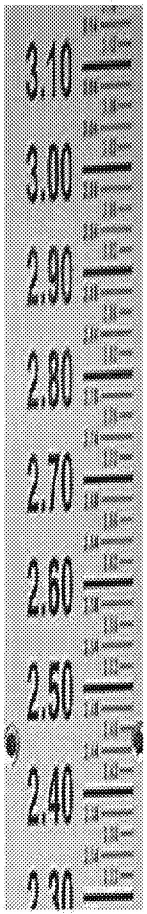
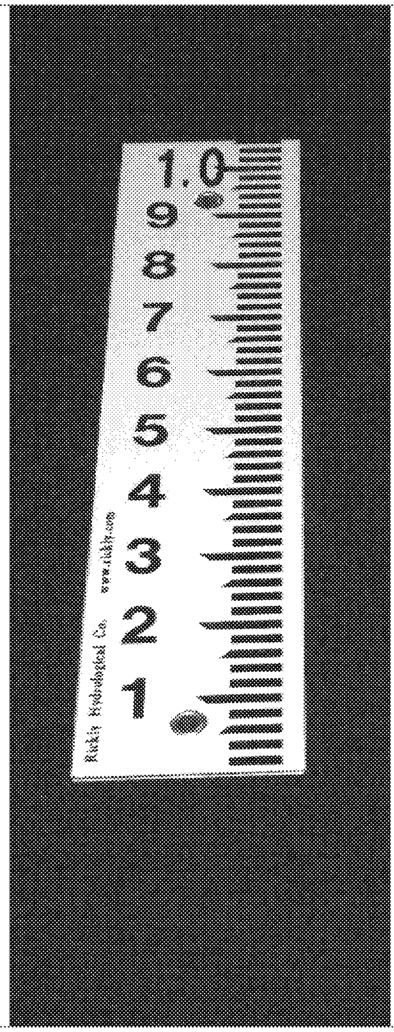
PROCEDURES

OPEN SUTRON HOUSING	1. Wearing work gloves, unlock the lock on the housing and remove the lock. 2. Use a flathead screwdriver and loosen each of the screws on the housing. 3. Unlatch the stays, open the housing door, and store the lock on top of the housing.
DOWNLOADING DATA	1. Turn the laptop computer on. 2. Connect laptop to Sutron data logger using USB to serial port adapter. 3. Open the Xterm software. 4. Depending on which field lap top you are using, choose a COM port. Try COM 2 and/or COM 6 and the default baud rate from drop-down menus. If the unit still won't connect, try other COM ports listed in the drop-down menu until you are able to connect. Click the bubble for direct connection and hit the ENTER key. 5. Choose either SETUP or RETRIEVAL ACCESS. 6. Go to LOG tab and click EXPORT. 7. Choose COMMA DELIMITED or other format. 8. Enter your START TIME and END TIME or choose SINCE LAST EXPORT, depending on what data range you need to retrieve. 9. Click OK and Save As. (Use a conventional name with the date and site name and save wherever you will be able to locate the file).

	10. Click SAVE and then CLOSE data window. 11. Ensure logging is still turned ON and the DATE/TIME is correct in X-Term. 12. If logging is turned off, click button to turn on. If DATE/TIME is incorrect in X-Term, highlight and type in correct DATE/TIME. 13. If water present in channel, read staff gage according to SOP-SW-06: Read SG. 14. If observed stage differs from stage set on SUTRON, adjust stage. To adjust inside stage reading, click * from the Sutron display. Scroll right until you see "Calibrate", then hit * again to enter calibration screen. You'll see the inside staff gage reading displayed, use the arrows to scroll to the digit to be edited, * to edit, and arrows again to change digit values. Once the desired value is input, use the arrow keys to scroll to the left, hit * once more to exit calibration. 15. X out of X-term or use LOGOUT. 16. Disconnect the communication cable. 17. Store the laptop.
CLOSE SUTRON HOUSING	1. Wearing work gloves, close the door of the Sutron housing. 2. Using a flathead screwdriver, tighten each of the screws. 3. Replace the housing lock and ensure it is locked.
STAFF GAGE MEASUREMENT	1. Read the staff gage and record the measurement in the field book and compare to the level displayed on the SUTRON datalogger.
DOCUMENTATION	1. In the field book, record the arrival time, the site name, the staff gage level, and the level on the recording system. Document that data was downloaded from the recorder.

SOP – SW – 06
READ STAFF GAGE

Authorized for use: 01/22/2018 Revision 2	
SCOPE	This SOP addresses reading a staff gage in an open water body.
TRA(s) Referenced/ Reviewed	TRA1-001: Common hazards Driving Trailer Load/Unload TRA1-008: SG Readings Download Sutron ISCO H350 Weather Station
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme Wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCB's
PPE REQUIRED	Hard Hat If in the water, waders If using boot foot waders, ankle braces If not in the water, Safety Toe Boots Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	At times, steel bar for ice removal and brush for cleaning staff gage
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
READ STAFF GAGE	1. Locate the staff gage 2. Remove any debris which has built up around/on the staff gage 3. Chip out any ice around the staff gage. Use an appropriate tool to chip ice and always wear heavy gloves. If ice is thin (< 0.5 inch) it can be removed with a shovel. If ice does not easily clear with a shovel or stick, use a steel bar. Hold the bar with both hands and very near the staff gage. 4. Wipe the staff gage clean so that markings can be clearly discerned (use brush, plastic or steel). 5. Read the staff gage to the nearest 0.01 foot. 6. If the type of staff gage pictured below left is utilized (standard USGS), each mark represents 0.02 feet. Therefore, values between marks are estimated as accurately as possible. On the staff gage pictured on the right, each mark is associated with 2 measurements. For example, the line that points toward the number 4 pictured below, the top of the line (pointed) would represent a stage of 0.40 feet. The lower part of the same line (indent), however, would represent 0.39 feet.

	 
DOCUMENTATION	1. In the field book, and on the field sheet if required, record the time, site name, and staff gage reading. If comparing the open water staff gage reading to a site recorder, and recorder stage is adjusted to the observed, note in log book that the stage on the recorder was adjusted.
REPORTING	1. Enter site name, date, time, and staff gage reading in the appropriate spreadsheet. 2. Spreadsheet can be found at: \\woodardcurran.net\shared\Offices\Bozeman\BUTTE\TREC\ARCO\LAO\SW 3. File name: SGReadings_2018 (or appropriate year).

SOP – SW – 07

CHANGE ISCO BATTERIES and SAMPLER MAINTENANCE– Ground Level ISCOS

Authorized for use: 01/22/2018
Revision 2

SCOPE	This SOP addresses changing 12-volt batteries on ISCO flow meters and samplers.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-011: Change ISCO Battery Ground Level
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDS	Lead Acid Battery
PPE REQUIRED	Hard Hat Safety Toe Boots / Felt-Soled Waders Ankle Braces (if necessary) Safety Glasses High Visibility Shirt/Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	ISCO battery
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
OPENING ISCO HOUSING	1. Wearing work gloves, unlock the metal housing. If possible, visually inspect the lock area prior to placing hands in the area. Insects are often within the lock area. Remove the lock(s) from hasp and store it/them on the handles of the metal housing. 2. Two types of ISCO storage boxes are present at the BPSOU. On one type, the lids are secured with two hasps and locks and the lids lift completely off the storage box. On the second type, the lid is hinged and is secured with one hasp and lock. If at the first type of box, lift the lid off the metal housing and set it on the ground, or against a sturdy structure. Place the lid clear of the immediate work area. If at the second type of box, lift the lid up, and let it rest on the chains, if no chains are present, lower it to the ground or use the wire that is attached to the willows or other structures to secure the lid open. Be careful to not set the lid on cables or lines.
CHANGING ISCO FLOW METER/ SAMPLER BATTERY	1. During Offseason (Sampler NOT Present) a. Remove the battery on the flow meter by unscrewing the battery connection. b. Handle the battery by the molded handles of the battery case. Do not lift or carry battery by the handle attached to the battery. c. Place the new battery on the cinder block next to the equipment and screw the connection into the proper port. d. Ensure that the flow meter has power and is turned on and note in the log book. 2. During Storm Sampling Season (Sampler Present) a. The sampler will power the flow meter. The sampler will be in line between the battery and the flow meter utilizing a six-pin cord. b. Unhook the closures on the lid to the sampler (if fastened). c. Remove lid. d. Unscrew the battery connection from the sampler. e. Remove the plastic case that contains the battery from the sampling box. Use the handles on the case to lift the battery. Do not lift by the cord on the outside of the plastic

	box and never remove batteries from plastic boxes. f. If maintenance is required on internal tubing or any other moving parts of the sampler, complete all maintenance on equipment while the power source is unhooked. For example, if internal tubing needs to be looked at and/or replaced, unhook power source, unscrew the pump case and check the tubing for wear or holes and replace as needed. Replace the pump case. Do not reconnect the battery until all maintenance is complete. g. Place the new battery in the security box and screw the connection into the proper port. h. Turn on sampler. i. Check the date and time on the sampler, make any necessary corrections. To make changes, first hit the STOP key. Press the ENTER PROGRAM key. Use the arrow key to choose Configure Sampler. At the Select Option (← →) Clock display, press the ENTER PROGRAM key. The display reads HH:MM DD MM YY. Make any necessary changes and proceed through the screen by pressing the ENTER PROGRAM key. Continue through the program until taken to the next screen. Press the EXIT PROGRAM key to return to the main display, which will read Program Halted. Press start sampling, and press ENTER two times in quick succession to inhibit sampler. j. Ensure that the sampler display reads Sampler Inhibited. k. Replace the lid onto the sampler, attach the three closures (when necessary). l. As a final precaution, trace all sampler/bubbler tubing in the box. Make sure that no equipment is resting on any of the lines or that the lines are not kinked.
CHECK ISCO STAGE LEVEL ON CREEK SAMPLERS	1. Lift the flow meter onto the top of the sampler. If no sampler is present, set the flow meter on the corner of the storage box, ensuring that it is resting on two walls of the box. 2. Read and record the staff gage level and remove debris from bubbler according to SOP-SW-06. Read and record the level on the flow meter. If the two levels agree proceed to step 9, however, if the two levels aren't in agreement, proceed to step 3. 3. Open the front of the ISCO flow meter by releasing the latches and opening the door. 4. Push and hold down the manual purge button. Purge the bubble line for 10 seconds. Allow ample time for the purge to finish and the air to reach equilibrium before beginning step 5. 5. Using the keys on the front of the flow meter, press GO TO PROGRAM STEP, then press 3. 6. This brings up the Parameter to Adjust Menu, use the right arrow key to choose Level. In the Level Menu, enter the correct stage using the numbers on the key board and hit enter. Use the EXIT PROGRAM key to get to the main display. 7. Check the date and time on the flow meter, make any necessary corrections. 8. To correct date or time, open the front of the ISCO flow meter by releasing the latches and opening the door. Press the ENTER PROGRAM STEP key. Use the arrow key and go to Setup, press ENTER PROGRAM STEP. Choose Clock, press ENTER PROGRAM STEP. The program steps through year, month, day, hour, and minute. Adjust any value as needed with the keypad numbers. After each adjustment, or to step to the next choice, press the ENTER PROGRAM STEP key. Continue pressing the ENTER PROGRAM STEP key until returned to the Setup menu. Press EXIT PROGRAM to return to the main screen. Proceed to step 10. 9. Open the front of the ISCO flow meter by releasing the latches and opening the door. Push and hold down the manual purge button. Purge the bubble line for 10 seconds. 10. Close and latch the door of the flow meter following directions in CLOSING ISCO HOUSING. 11. Lifting it by the handle, replace the flow meter to its original position within the metal housing. 12. As a final precaution, trace all sampler/bubbler tubing in the box. Make sure that no equipment is resting on any of the lines.
CLOSING ISCO HOUSING	1. Place the metal lid onto the housing, taking care to line up the lock cover(s) with the hasp tab(s). 2. Place the hasp(s) over the tab(s), lock the lock(s). (where applicable) 3. Proceed to the next site following all applicable SOPs.

SOP – SW – 08

AUTOMATIC AND MECHANICAL SAMPLER SET-UP – CREEK

Authorized for use: 01/24/2018
Revision 2

SCOPE	This SOP is for the initial installation of mechanical (D-TEC) and automatic (ISCO) samplers. This SOP is limited to creek sites according to instructions and programming.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-009: Collect Sample and install DTEC Sampler TRA1-012: Collect samples, install and maintain ISCO sampler above ground TRA1-028: SS-07
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Water greater than three feet deep
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCP
PPE REQUIRED	Hard Hat Safety Toe Boots/waders If using boot foot waders, ankle braces Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers Ear Protection
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Metal fence posts, heaviest gage steel, 5.5 feet in length recommended; Post pounder Clear vinyl $^3/_8$" ID tubing Bubbler line ($^1/_8$" ID clear vinyl tubing from ISCO) $^1/_8$" stainless steel tubing, with a 90° bend at one end ISCO sampler strainer Cable ties Duct tape Scissors or side cutters D-TEC sampler D-TEC sampler bracket D-TEC bracket clamp ¼ " Hex wrench Hose clamps ISCO sampler/flow meter communication cable Elbow length gloves 12-V ISCO batteries Hand Tools Measuring Tape
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Jacqueline Dudding Janelle Garza Daniel Cass Caleb Arbaugh

	Michael Picker
PROCEDURES	
SETTING THE SAMPLER POSTS	1. Find an appropriate location to set the posts. Avoid areas in which large (>1 ft diameter) rocks are known to exist in the streambed. 2. In areas that the stream is not well mixed, the sampler will need to be set mid-stream. It is best to secure the sampler tubing to the stream bed if possible. If that is not possible, insert the vinyl tubing in flexible conduit. 3. In areas that the stream is well mixed, the sampler can be set near the bank from which the site is accessed. If possible, bubbler tubing should always be placed near the bank from which the site is accessed. 4. Keep in mind that in high flows debris and water will travel downstream; and if the tubing is lying across the water surface, it may become kinked, preventing water from being pumped to the sampler or it could get ripped out potentially damaging sampler. 5. It is best to minimize the number of posts in the stream, so if conditions allow, the bubbler tubing, ISCO sampler tubing, and D-TEC sampler should all be secured to the same set of posts. 6. Site the posts so that once tubing is attached to the posts, the lengths of tubing will not create a tripping hazard to personnel accessing the site.
SETTING SAMPLER POSTS	1. A ground disturbance permit is needed if the post goes deeper than 12". Mark the post at 12" before pounding, if it reaches the mark stop work and obtain a ground disturbance permit before proceeding. Another method for preventing the post from entering the ground less than 12" is to fasten a hose clamp to the t-post, allowing you to see it when it becomes covered with water. 2. One person shall loosely hold the post in place, near the base of the post, but above the water level. The post will move once pounding begins. 3. The other person shall slip the post pounder over the top of the post once the post is in position. 4. Before pounding the post, be certain that all hands are clear of area of impact of the pounder. Remember that the post will move once it is pounded, so do not have a tight grip on the post. If it is possible for the post to remain in place without being held, then the post need not be held up by the second person. 5. Put on the appropriate ear protection before proceeding. Pound the post once by holding the pounder firmly in two hands. Raise the pounder towards the top of the post and then bring it down with force onto the top of the post. When raising the pounder, do not bring the bottom of the pounder above the top of the post. After the post has been pounded one time (it may take a few times), if the post remains in place on its own, the second person should remove their hands from the post. 6. The second person will remain on-site and watch for debris floating into the work area. 7. Continue pounding the post until the post is secure but no farther than 12" unless a ground disturbance permit has been issued.
PREPARING TUBING	1. Bubbler tubing is procured from Teledyne ISCO. A length of bubbler tubing sufficient to reach from the flow meter to the stream is needed. One end of the tubing is placed on the appropriate fitting on the flow meter; the other end of the tubing is fitted over the $^1/_8$" stainless steel tubing. The other end of stainless tubing will be placed in the water. Ensure that the connection between the flow meter and tubing is tight. 2. An adequate length of $^3/_8$" ID clear vinyl tubing is used for the ISCO sampler. One end of the tubing is placed on the appropriate fitting on the sampler. The strainer is placed on the other end of the tubing and secured to the tubing with a hose clamp. The protective cover which is part of the strainer is slid over the strainer/tubing connection point. 3. Measure and record the sampler tubing length. This measurement must be entered in the sampler setup program. 4. At many sites, it is necessary to run the tubing through flexible conduit to prevent damage to the tubing. For example, where the tubing will be placed mid-channel or where animals may chew through the tubing. In such cases, run the tubing through the conduit prior to attaching the stainless-steel piece (flow meter tubing) or the strainer (sampler tubing).
ATTACHING SAMPLER/TUBING TO POSTS	1. The intake (strainer) of the automatic sampler is attached at the base of the post, near the stream bed. The strainer should be submerged but it needs to be secured so it is not touching the bottom of the stream bed to prevent burying and sample bias. Attach the strainer to the fence post with cable ties. Trim the ends of the cable ties. 2. With the ISCO flow meter, one end of stainless steel tubing will be submerged. Be certain that the tubing inlet is submerged to a depth that it will remain under water should the water level

	drop. Attach the stainless-steel tubing securely to the post with cable ties. Attach it in a way that it will not move up or down. Trim the end of the cable ties.
PROGRAMMING SAMPLER	1. The ISCO sampler and flow meter must be programmed for the proper length of tubing, the vertical rise, and sampling regime. 2. Attach a battery to the ISCO sampler/flow meter following the steps in SOP-SW-07 Batteries ISCO-Ground and Sampler Maintenance 3. On the sampler, press Enter Program 4. Use the right arrow key to go to Configure Sampler 5. Ensure that the date and time are correct 6. At Bottles and Sizes, choose Portable, 24, 1000ml 7. At Suction Line, choose 3/8, Vinyl 8. At Suction Line Length, enter the length of suction line that was measured previously. 9. At Liquid Detector, choose Enable 10. Choose 1 Rinse Cycle 11. At Enter Head Manually, choose Yes and enter the estimated head. 12. Enter Retry Up to 1 Times When Sampling 13. Press Exit Program 14. Press Enter Program 15. Choose Program Sampler- Complete with appropriate sampling routine. Sampling routines can be found on-line in Drop Box. The folder name is Programming. File is called Configure-Program Creek ISCO Samplers (regulatory monitoring). 16. Press Exit Program
PROGRAMMING FLOW METER	1. On the flow meter, press Go to Program Step, 5 2. At Sampler Pacing, choose Conditional 3. At Condition, choose Level 4. At Level, choose Greater Than 5. At Level Greater Than, enter 0.001 foot less than the level at which the sampler should collect. (This level should have been recorded prior to leaving the office.) For example, if the sampler should collect at 1.50 ft, enter 1.499 feet. 6. At Operator enter Done 7. At Condition True Pacing Interval, enter Pace every 60 Minutes 8. At Condition False Pacing Interval, enter Pace every 60 Minutes 9. At Sampler Enable Mode, choose Conditional 10. At Condition, choose Level 11. At Level, choose Greater Than 12. At Level Greater Than, enter the same level that was entered above. 13. At Operator, choose done 14. At When Enable Condition is No Longer Met, choose Keep Enabled 15. At Plotter On/Off with Enable, choose No 16. At Plotter Speed, choose Off 17. Press Exit Program
PREPARE SAMPLER/FLOW METER FOR SAMPLE COLLECTION	1. Read and record the staff gage level according to SOP-SW-06 Read SG. 2. Set the ISCO level to the staff gage level. To do so, press Go to Program Step 3. At Parameter to Adjust, choose Level, at Level enter the correct level. Press Exit Program. 3. Attach the ISCO sampler/flow meter communication cable to the appropriate connections on the sampler and flow meter. 4. On the sampler, press start sampling, then press Enter 2 times. 5. The sampler display should say Sampler Inhibited.
SETTING D-TEC SAMPLERS	1. Mechanical samplers will be attached with the clamp that is provided as part of the sampler. A ¼ inch hex wrench is required for attaching the clamp to the fence post. Secure the bracket to the fence post and tighten the bracket so that the mechanical sampler is at the appropriate height. 2. D-TEC samplers are set to pre-defined stages and that stage should be known and recorded prior to leaving the office. To measure the D-TEC sampler intake stage, read the staff gage level. Adjust the sampler intake to the desired stage by measuring the difference between the water level and the sampler intake. Adjust the sampler up or down until the desired stage is reached. Record the sampler intake stage.
DOCUMENTATION	1. Record all installation information in the logbook and/or installation sheet (if applicable).

SOP – SW – 09
COLLECT SAMPLE FROM D-TEC SAMPLER

	Authorized for use: 01/24/2018 **Revision 4**
SCOPE	This SOP describes the sample collection and decontamination process of D-TEC mechanical samplers.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards, Driving, Trailer, Load/Unload Equipment TRA1-008: SG, Download HOBO Logger TRA1-009: Collect DTEC Sample TRA1-028: SS-07
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDSs	Arsenic Cadmium Copper Lead Mercury Zinc PCP (SS-06A and downstream)
PPE REQUIRED	Hard Hat Waders If using boot foot waders, ankle braces Safety Glasses High Visibility Shirt or Vest Gloves (leather, impervious) Long Sleeve Shirt Long Trousers Life jacket (if conditions dictate) Throw ring (if conditions dictate)
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Spare sample bottles Decontamination sprayer filled with tap water
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
	PROCEDURES
CHECK SAMPLER	1. Read and record the staff gage level following SOP-SW-06_ReadSG (If staff gage present) 2. Enter the stream or channel and proceed to the D-TEC sampler. 3. Remove any debris that has piled against the post holding the sampler. 4. Check the sampler to see if it has closed, if closed it is likely the sampler is full. 5. If the sampler is open, remove the pin holding it in the bracket, and lift it out of the bracket to ensure that it is empty. It is possible for the sampler to collect without closing. 6. If the sampler is empty, replace it in the bracket and replace the pin. If the sampler is full, proceed to Retrieve Sample step 1.
RETRIEVE SAMPLE	1. Remove the full bottle from the bracket. 2. Go to a level work area, the tailgate of the truck is preferable. 3. Using the decontamination sprayer filled with tap water, rinse any sediment/sand from the outside of the sample bottle. 4. Remove the sampling head from the bottle. Place a lid on the bottle. Place a label on the lid with the correct site name and date of storm. Store the sample in a cooler on ice.
SAMPLER	1. Disassemble the sampling head. Remove the nut on top of the plexi-glass cover. Pull the

DECONTAMINATION	metal screen off the lower portion of the sampler head. Remove the plexi-glass cover from the screen. 2. With a pressurized decontamination sprayer containing tap water, thoroughly rinse each portion of the sampler head. If the sample is to be discarded, thoroughly rinse the sample bottle. 3. Reassemble the sampling head. 4. Some DTEC's are modified. The automatic sampling head may be replaced with a solid white lid with a hole drilled in it. The sample bottle will contain a ping pong ball. Deconn the lid and the ping pong ball using the pressurized decontamination water and replace the lid on a clean DTEC bottle after inserting the deconned ping pong ball.
RESET SAMPLER	1. With a clean replacement bottle (if a sample was collected) or a deconned bottle (if the sample was disposed of) and the deconned sampler head, return to the sampler bracket in the stream or channel. 2. Reset the spring on the sampler, so that the sampler is open (sampler head). 3. Carefully replace the sampling head on the bottle, ensuring that the sampler remains open. 4. Place the sampler in the bracket. 5. Replace the pin holding the sampler in the bracket. 6. If DTEC sampler is modified, replace deconned sampler back into bracket.
DETERMINING SAMPLE TIME FOR CREEK SAMPLES AND DIAGNOSTIC SAMPLES	1. For DTEC's located in the stream, sample time is determined by downloading the ISCO flow meter. Follow SOP-SW-04 DOWNLOAD ISCO STAGE RECORDER (4200 or 2150 models). After retrieving the stage file for the site in question, locate the time, during the wet weather event, when the stage first reached the sample stage criteria (rising limb). Document the collection time in the log book and on the electronic form. 2. For DTEC's located at sites other than the creek, temperature data will be downloaded from the HOBO logger connected to the sampler. 3. Open HOBOware software on laptop. 4. Attach the USB end of the HOBO Pendant Coupler to the laptop. 5. Mate the logger to the coupler, assuring that the ridge on the HOBO logger aligns with the groove inside the Pendant Coupler. 6. Confirm you are connected, check lower right-hand corner, there will be a display of "1 device connected". 7. Click Device in the dropdown menu and select Readout or click the 2nd picture below the dropdown menu on the left. 8. Save file to desktop, HOBO downloads with site name and date. Example: MGEFS-5B_012318. 9. Hit Save and then plot. 10. A graph will appear on the screen. 11. Using the spreadsheet in the top half of the screen. Locate the approximate start time of the storm. Click on the temperature value and a red line will appear on the graph. Use the up and down arrows to scroll through the data to locate a significant temperature change (temperature change may be an increase or decrease depending on ambient conditions). 12. Record the date and time the storm started in the logbook and on the electronic collection sheet. 13. Click Device in the dropdown menu and select Launch or click the 1st picture below the dropdown menu on the left. 14. A Launch Logger box will appear. Confirm the name of the site, check the battery level, and check that the logging interval is set for 10 minutes and click start. A save data file box will appear, click Don't Save. 15. Remove logger from Pendant Coupler.
DOCUMENTATION	1. Follow **Butte – StW I-Pad Steps –smpl** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20I-Pad%20Steps%20-smpl.aspx in order to record all field data on the tablet. 2. Label the DTEC bottle lid with a label or duct tape marked with the site name, sample date and time sample collected. 3. Record the sample date and time in the logbook and on the electronic collection form. Project: Butte Form: Butte – StW Smple Clctn r0

SOP – SW – 10

AUTOMATIC AND MECHANICAL SAMPLER SET-UP – DIAGNOSTIC

Authorized for use: 01/24/2018
Revision 0

SCOPE	This SOP is for the initial installation of mechanical (D-TEC) and automatic (ISCO) samplers. This SOP is limited to diagnostic sites according to instructions and programming.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-009: Collect Sample and install DTEC Sampler TRA1-012: Collect samples, install and maintain ISCO sampler above ground TRA1-013: Collect samples, change battery in manhole TRA2-001: Permit install/uninstall storm drains (manhole locations)
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Water greater than three feet deep
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCP
PPE REQUIRED	Hard Hat Safety Toe Boots/waders If using boot foot waders, ankle braces Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers Ear Protection
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Metal fence post/length of rebar Post pounder or heavy-duty hammer ISCO sampler strainer Cable ties Duct tape Scissors or side cutters D-TEC sampler D-TEC sampler bracket D-TEC bracket clamp ¼ " Hex wrench Hose clamps ISCO sampler/flow meter communication cable Elbow length gloves 12-V ISCO batteries Hand Tools Measuring Tape Laptop with Flowlink 5.1 software
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker

PROCEDURES	
SETTING SAMPLER POST(S)	1. Find an appropriate location to set the posts. Avoid areas in which large (>1 ft diameter) rocks are known to exist in the drainage. 2. Keep in mind that in high flows debris and water will travel downstream; and if the tubing is lying across the water surface, it may become kinked or pulled downstream, preventing water from being pumped to the sampler and possibly damaging the sampler. 3. It is best to minimize the number of posts, so if conditions allow, secure all lines to the same post (or set of posts). 4. Site the posts so that once tubing is attached to the posts, the lengths of tubing will not create a tripping hazard to personnel accessing the site. Flag or spray-paint lines so personnel are aware of potential trip hazards.
SETTING SAMPLER POSTS	1. A ground disturbance permit is needed if the rebar or post goes deeper than 12". Mark at 12" before pounding, if it reaches the mark - stop work and obtain a ground disturbance permit before proceeding. 2. Before pounding the post, be certain that all hands are clear of area of impact of the pounder. Remember that the post will move once it is pounded, so do not have a tight grip on the post. If it is possible for the post to remain in place without being held, then the post need not be held up by the second person. 3. Don appropriate ear protection (if using post pounder). Ensure that the rebar/post are securely installed and won't be washed away with stormwater. 4. Continue pounding the post until the post is secure but no farther than 12" unless a ground disturbance permit has been issued.
PREPARING TUBING	1. An adequate length of $^3/_8$" ID clear vinyl tubing is used for the ISCO sampler. One end of the tubing is placed on the appropriate fitting on the sampler. The strainer is placed on the other end of the tubing and secured to the tubing with a hose clamp. 2. Measure and record the sampler tubing length. This measurement must be entered in the sampler setup program. 3. At many sites, it is necessary to run the tubing through flexible conduit to prevent damage to the tubing. For example, where the tubing will be placed mid-channel or where animals may chew through the tubing. In such cases, run the tubing through the conduit prior to attaching the strainer.
ATTACHING SAMPLER/TUBING	1. The intake (strainer) of the automatic sampler is attached at the base of the post, near the center of channel – if possible. If installing intake/actuator at a brand new location, both should be situated as low as possible (or approximately ½" from the bottom of channel.) Once site data (such as sample timing, drainage discharge, and ponding probability) have been acquired, the intake and actuator heights should be adjusted as appropriate. 2. With the ISCO area-velocity meter, secure the sensor to the tabs on either plate or ring – depending on diagnostic site location.
PROGRAMMING SAMPLER	1. The ISCO sampler and flow meter must be programmed for the proper length of tubing, the vertical rise, and sampling regime. 2. Attach a battery to the ISCO sampler/flow meter following the steps in SOP-SW-07 Batteries ISCO-Ground and Sampler Maintenance 3. On the sampler, press Enter Program 4. Use the right arrow key to go to Configure Sampler 5. Ensure that the date and time are correct 6. At Bottles and Sizes, choose Portable, 24, 1000ml 7. At Suction Line, choose 3/8, Vinyl 8. At Suction Line Length, enter the length of suction line that was measured previously. 9. At Liquid Detector, choose Enable 10. Choose 1 Rinse Cycle 11. At Enter Head Manually, choose Yes and enter the estimated head. 12. Enter Retry Up to 1 Times When Sampling 13. Press Exit Program 14. Press Enter Program 15. Choose Program Sampler- Complete with appropriate sampling routine. Sampling routines can be found online in Drop Box. The folder name is Programming. File is called Configure-Program Diagnostic ISCO Samplers (either 2.5 hour, 5 hour, or Parallel Monitoring) 16. Press Exit Program
PROGRAMMING AREA/VELOCITY METER	1. Connect communication cable (USB end to computer and 6-pin end to top of a/v meter).

	2. Using the laptop, open Flowlink 5.1, select comport from dropdown, and click on 2100 series to connect to unit. 3. Complete Area/Velocity programming with inputs from spreadsheet on Dropbox. The folder name is Programming. File is called Area Velocity Meter Programming
SETTING D-TEC SAMPLERS	1. Mechanical samplers will be attached with the clamp that is provided as part of the sampler. A ¼ inch hex wrench is required for attaching the clamp to the fence post. Secure the bracket to the fence post and tighten the bracket. The bottom of the diagnostic D-TEC sampler is generally placed on or very near the bottom of the channel. Using a tape measure, measure from the channel surface to the sampler intake and record this value in the logbook along with a description of sampler location in relation to bottom of channel.

SOP – SW - 11

D-TEC WET WEATHER SAMPLE PREPARATION

Authorized for use: 01/24/2018 Revision 4	
SCOPE	This SOP addresses the in-office preparation of wet weather surface water samples from mechanical samplers for laboratory submittal. This SOP is specific to BPSOU Wet Weather samples collected in D-TEC samplers.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-037: Prepping Preparing Sampling Lab
STOP WORK TRIGGERS	Unfit for duty Unsafe conditions Inadequate PPE or equipment Defective Equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCP HNO_3 H_2SO_4 Liquinox
PPE REQUIRED	Safety Glasses Impervious gloves Long Sleeve Shirt Long Trousers Closed-toe footwear
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Sample bottles Filters Peristaltic pump 12-Volt peristaltic battery or peristaltic pump AC adaptor Tubing
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
SET-UP	1. Wear safety glasses. 2. Prepare a clean, clutter free work area. 3. At all times, wear impervious gloves. Change gloves between samples, or more frequently if gloves become soiled. 4. If the sample volume available for rinsing containers is limited, or not sufficient to adequately rinse the bottles, use DI to rinse the bottles. 5. If using pre-preserved bottles, do not rinse the bottles. If using certified bottles, and the bottle is not pre-preserved, one rinse with a very small volume of sample or deionized water is sufficient. 6. Set laboratory bottles up in the order they will be filled. Write the distinct numeric portion of the sample identification number on the lid of each bottle. Write an “F” on the bottle to be used for dissolved metals analysis.
SAMPLE PREPARATION	1. Each sample will consist of one ½-gallon bottle. This bottle will be homogenized prior to pouring out sample aliquots. Invert the half-gallon bottle several times to re-suspend all

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	sediment in the container. Use two hands. Do not shake the bottle vigorously. It may be necessary to swirl the bottle to re-suspend sediment sitting on the bottom of the bottle. 2. For all aliquots other than dissolved metals and dissolved organic carbon, carefully pour sample from the ½-gallon bottle into the sample bottles. Do not place hands inside any bottles. If necessary, use two hands to pour. The general chemistry bottle should be the second or third sample aliquot poured. Avoid overfilling pre-preserved sample bottles. 3. To prepare the dissolved metals and dissolved organic carbon aliquot, use the peristaltic pump with clean tubing. Place the clean pump tubing inside the ½-gallon bottle. Place a 0.45-micron filter on the outgoing end of the tubing. Pump from the bottle containing the raw sample into the DOC bottle, and then into the dissolved metals bottle. If the bottle is pre-preserved, avoid overfilling the bottle. The filtered aliquot is the last aliquot prepared for each sample. 4. Bottle and preservations requirements for creek are as follows: • Total Metals 250 mL plastic, HNO_3 preserved • Dissolved Metals 250 mL plastic, filtered, HNO_3 preserved • NO_2/NO_3 250 mL plastic, H_2SO_4 preserved • Dissolved Organic Carbon 250 mL amber glass, filtered, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) • TDS, TSS, Alkalinity, SO_4 500 mL plastic, no preservative, zero headspace • TKN 250 mL plastic, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) • NH_3, 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01 and only on first wet weather event of the month) • Total Phosphorous 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) Bottle and preservations requirements for storm drains are as follows: • Total Metals: 250 mL plastic, HNO_3 preserved • Dissolved Metals: 250 mL plastic, filtered, HNO_3 preserved • TSS and SO_4: 500 mL plastic, unfiltered, no preservative 5. On creek samples, if there is inadequate sample volume to fill all bottles, fill metals and TKN (if applicable) bottles only half to three-quarters full. 6. Dry sample bottle, and immediately place appropriate label on appropriate bottle.
DECONTAMINATION	1. Since DTEC samples represent only one sample per site, peristaltic pump tubing will be disposed of after preparing the sample.
PRESERVING SAMPLES	1. If using pre-preserved sample bottles, no additional preservation is necessary. 2. If using sample bottles that have not been pre-preserved, wait until the end of the sample preparation shift to preserve samples. While preparing samples, set samples requiring differing preservatives in separate spaces. Raw (no preservative) samples should be stored in the refrigerator or on ice if refrigeration is not available. Bottles prepared for total and dissolved metals analysis should be set in a designated area. Bottles prepared for NO_2/NO_3, DOC, TKN, NH_3, and total phosphorous analysis should be set in an area separate from those prepared for metals analysis. Preserve all bottles prepared for metals analysis, then preserve all bottles prepared for nutrient analysis, or vice versa.
SAMPLE STORAGE	1. Refrigerate or cool all samples until laboratory delivery.
DOCUMENTATION	**1. Transformer Steps** Follow **Butte – StW Processing Steps: I Transformer Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20Processing%20Steps.aspx. **2. Download doForms** Download "Butte – StW Smple Clctn r0" doForms by following **DoForms Online Download Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/DoForms%20Online%20Download%20Steps.aspx. **3. Prep/COC Steps** Follow **Butte – StW Processing Steps: II Prep/COC Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20Processing%20Steps.aspx. **4. Labels:** Use the appropriate pre-labeled ID or write in the ID associated with the sample. Add a dash

	and the date stamp recorded by the ISCO (-mmddyy) to the ID. Put the date of sample on the "date" line. If preparing the ECB/FB, the date and time will not be obtained from the ISCO but will be the actual date and time you are doing the prep. The Duplicate sample will be given the same date and time as the Natural sample. Put the time the sample was collected on the "time" line. Provide the initials of the people preparing the samples on the "sampled by" line. **5. File Organization** Ensure that all documentation is complete and organized appropriately by following **Butte – StW File Organization Details** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20File%20Organization%20Details.aspx
SHIPPING	1. Make sure the number of containers listed on the COC is correct to the number of sample bottles. Check to make sure that the sample ID and date stamp, date, and time match the COC. Ensure that there are initials of the preppers on the "sampled by" line and that the appropriate label (analysis) is on the correct bottle. Confirm that all lids are sealed properly and use duct tape to secure the lids on the 500 mL and 1000 mL bottles. 2. Make any necessary changes to labels or the COC before packing. When the COC is correct, the person who is in the "Sampler's Name" box should sign under "Relinquished By / Affiliation" column on each page of the COC. Copy the COC to be filed with the shipping label receipt in the monthly file. Place the original COC in a zip lock bag and place it on top of the ice in one of the coolers to be shipped. 3. Special packing instructions for specific bottles: • Duct tape all raw bottle lids to the bottle. The lids on these bottles do not seal well, and often spill during shipment. • All amber glass bottles must be wrapped in bubble wrap and placed in a cooler of their own. If the glass bottles must be included in a cooler with other samples, surround all the bubble wrapped amber bottles with additional bubble wrap to separate them from the other samples in the cooler. Line the bottom of the cooler with a bubble sheet, and then top the bubble-wrapped bottles with another bubble sheet before closing and securing the cooler. 4. Fill all coolers as full as you can without squeezing bottles in too tight. If on the last cooler, there are not enough sample bottles to completely fill the space, use any kind of appropriate filler to prevent bottles from falling over or sliding during shipment. 5. Confirm that all coolers contain a temperature blank. 6. Place ice bags in a zip-lock bag and place two (winter) or three (summer) bags of ice on top of the bottles. Close the lid tight and duct tape the seal twice over. Place an address label on the top of the cooler and a custody seal over the front latch of the cooler. Attach the shipping label to the top of the cooler. Using packing tape, tape around the entire cooler (top to bottom) to secure the shipping label and the custody seal. Then proceed to tape over the duct tape seal twice. 7. Shipping Label: • In the From section: fill out the Date, Sender's Name, Phone, Company (TREC, Inc.), Address (1015 S. Montana St., Ste. C), City (Butte), State (MT), and Zip (59701). • In the To section: fill out Recipient's Name (Sample Receiving), Phone (612-607-1700), Company (Pace Analytical), Address (1700 Elm St. SE), City (Minneapolis), State (MN), and Zip (55414-2485). • In Express Package Service, check FedEx Standard Overnight when shipping Monday through Thursday, or "FedEx Priority Overnight" if shipping on a Friday. • In Special Handling and Delivery Signature Options, check SATURDAY Delivery if shipping on a Friday only. Check No under Does this shipment contain dangerous goods? • In Payment, check Recipient and fill in the FedEx Acct. No. as 9860-02219. Fill in the number of coolers being sent under Total Packages. Each coolers weight is approximately 65 pounds. 65 * total number of coolers is entered in "Total Weight". 8. Make enough copies of the shipping label to go on each cooler. Place the shipping labels in a clear sleeve, stick the sleeve onto the top of the cooler and tape completely around the cooler with packing tape. 9. TDS and TSS analysis have short hold times of seven days. Email Shawn Davis Shawn.Davis@pacelabs.com or contact him at Pace (612-607-6378) to notify him that short-hold samples are being shipped. Be prepared to tell him the earliest sample collection time.

	10. Either call for a pickup from FedEx or deliver the coolers to FedEx. Coolers must never be left unattended (locked in lab is fine) until delivered for shipment or pick-up by carrier is complete. Make sure to take the Sender's Copy of the shipping label to secure to the copy of the COC and place in the appropriate month in the filing cabinet.

SOP – SW – 12

Surface Water Wet Weather Sample Preparation

Authorized for use: 01/25/18 Revision 4	
SCOPE	This SOP addresses the in-office preparation of surface water samples from mechanical and automatic samplers for laboratory submittal. This SOP covers the preparation of BPSOU Surface Water Wet Weather samples as well as Diagnostic Storm Drain samples.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-037: Prepping Preparing Sampling Lab
STOP WORK TRIGGERS	Unfit for duty Unsafe conditions Inadequate PPE or equipment Defective equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc PCP HNO_3 H_2SO_4 Liquinox
PPE REQUIRED	Safety glasses Latex/nitrile gloves Long-sleeve shirt Long trousers Closed-toe footwear
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Sample bottles Filters Peristaltic pump 12-Volt peristaltic battery or peristaltic pump AC adaptor Silicon tubing
Trained, Competent and Authorized Employees in this SOP	Alice Drew Davies Tina Donovan Janelle Garza Dan Cass Caleb Arbaugh Michael Picker
PROCEDURES	
SET-UP	1. Wear safety glasses. 2. Prepare a clean, clutter free work area. 3. At all times, wear latex or nitrile gloves. Change gloves between samples, or more frequently if gloves become soiled. 4. If using pre-preserved bottles, do not rinse the bottles. If using certified bottles, and the bottle is not pre-preserved, one rinse with a very small volume of sample or deionized water is sufficient. 5. Prepare samples requiring like analyses in batch. That is, first prepare all natural and quality control samples for sites SS-01, SS-06G, and SS-07. Next prepare all natural and quality control samples for sites GG-BTC, SS-04, SS-05, SS-05A, and SS-06A. 6. Set laboratory bottles up in the order they will be filled. Write the distinct numeric portion of the sample identification number on the lid of each bottle. Write an "F" on the bottle to be used for dissolved metals analysis and DOC if applicable.
SAMPLE PREPARATION	1. Try to prepare samples from "cleanest" to "dirtiest". Prepare samples from individual ISCO samplers in a consistent order (For eight sample samplers, the order is almost always bottle

8 to bottle 1).

2. Each sample will consist of three individual one-liter bottles. These bottles are composited at the time of collection, by filling each bottle 1/3rd full at set intervals. Since these samples are composites, it is not necessary to re-composite the sample during preparation. Prior to pouring samples, invert the 1-liter bottle several times to re-suspend all sediment in the container. Use two hands. Do not shake the bottle vigorously. It may be necessary to swirl the bottle to re-suspend sediment sitting on the bottom of the bottle. Even if sediment is not visible in the sample bottle, invert the bottle three times to mix the sample.
3. Do not place hands inside any bottles. Use two hands to pour if necessary. Ensure that sediment is remaining in suspension throughout the entire pouring process. If necessary, re-suspend between filling each bottle.
4. Chose a one-liter ISCO bottle from the sample set being prepared. This ISCO bottle will be used to pour the sample for general chemistry parameters. Preservation is not required, for the general chemistry sample, thus the laboratory bottle should be rinsed prior to pouring the source water into it. To rinse the bottle, invert the source water bottle (using the method described in step 2) to re-suspend sediment and pour a small amount of the water from the ISCO bottle into the sample bottle. Rinse the bottle by inverting it three times. Attempt to coat all interior walls of the bottle. Discard the rinse water down the sink. If pouring the raw sample for the storm drains, continue to step 5. For natural, duplicate and ECB/FB samples, use a 500 mL bottle instead of a 1 Liter bottle when prepping the creek. Re-suspend any sediment in the sample by inverting the 1-liter ISCO bottle several times. Pour the entire contents of the mixed ISCO bottle into the rinsed 1-liter laboratory bottle (500 mL if QC set) attempting to capture all sediment. If this does not completely fill the 1 Liter bottle, thoroughly mix the second ISCO bottle, (using the method described in step 2). Top the 1-liter laboratory bottle off with water from the second ISCO bottle. The raw bottle (for the creek) must have zero head space due to the alkalinity analysis. After filling the bottle, cap it and invert it to see if there are any air bubbles. If there are air bubbles in the sample, tap the side of the bottle until all the bubbles collect at the top, flip the bottle back over so that the bubbles go into the lid. Take the cap off, fill the cap with a small amount of sample water, carefully pour the water from the lid into the bottle, and attempt to put the lid on without creating more air bubbles. Repeat this process until zero head space is achieved.
5. For raw diagnostic samples, rinse a 500 mL plastic sample bottle as described above. Fill the bottle, from the 1 Litre ISCO bottle. As there is no alkalinity analysis required, the zero-headspace requirement is omitted.
6. For creek samples, continue with the second 1 Liter sample bottle used in step 4. After re-suspending, fill a plastic 250 mL sulfuric acid preserved bottle for NO_2/NO_3 – (at SS-01, SS-06G, and SS-07 - NH_3 and total phosphate analysis is required from this bottle the first storm of the month). A second sulfuric acid preserved bottle is filled for TKN at these same sites the first storm of the month. Sites GG-BTC, SS-05, SS-04, SS-05A, and SS-06A pour one unfiltered sulfuric acid bottle.
7. Each ISCO sample set uses the same internal tubing on the peristaltic pump. The tubing is deconed in between samples as described below in the Decontamination section. At the beginning of each ISCO sample set, install tubing on the peristaltic pump. Place a 0.45-micron filter on the outlet end of the tubing (a new filter with each sample). Pour a small quantity of sample water onto the outside of the inlet tubing and place in the 1 Liter Isco bottle. Pump the remaining volume from this bottle through the new (if first sample of the set) or previously decontaminated tubing and new filter. Allow the intake tubing to remain in the sample bottle until you are ready to filter the dissolved metals.
8. For the creek use the final 1 Liter ISCO bottle to prepare the total and dissolved metals and dissolved organic carbon aliquot (first storm of the month SS-01, SS-06G, and SS-07). Invert the bottle (as described previously) and pour sample water into a nitric preserved bottle for the total metals analysis. Remove the intake tubing from the empty sample bottle and insert into the bottle you poured the total metals out of. Turn the pump on and allow a small quantity of sample to flow through the tubing and filter before beginning to collect into a nitric acid preserved bottle (dissolved metals). Because the decon is done with nitric acid, the dissolved metals should be collected before the DOC (when applicable). Collect a filtered aliquot into the amber glass, sulfuric acid preserved bottle for DOC. For storm drain samples, invert the ISCO bottle (as described previously) and fill a 250 mL nitric preserved bottle. Pour a small quantity of the remaining sample water onto the inlet side of the tubing and place the tubing into the 1 L Isco bottle. Pump sample water through the new (if first sample of the set) or previously decontaminated tubing and new filter to rinse the system and then collect the

	filtered aliquot for the dissolved metals. Step 9 contains all bottle and preservation requirements for creek and storm drain samples. 9. Bottle and preservations requirements for creek baseflow samples are as follows: • Total Metals 250 mL plastic, HNO_3 preserved • Dissolved Metals 250 mL plastic, filtered, HNO_3 preserved • NO_2/NO_3 250 mL plastic, H_2SO_4 preserved • Dissolved Organic Carbon 250 mL amber glass, filtered, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) • TDS, TSS, Alkalinity, SO_4 1000 mL plastic, no preservative, zero headspace • TKN 250 mL plastic, H_2SO_4 preserved (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) • NH_3, 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01 and only on first wet weather event of the month) • Total Phosphorous 250 mL plastic, H_2SO_4 preserved (analysis from NO_2/NO_3 bottle) (only required on sites SS-07, SS-06G, and SS-01 and only on the first wet weather event of the month) Bottle and preservations requirements for storm drains are as follows: • Total Metals: 250 mL plastic, HNO_3 preserved • Dissolved Metals: 250 mL plastic, filtered, HNO_3 preserved • TSS and SO_4: 500 mL plastic, unfiltered, no preservative. 10. If there is inadequate sample volume to fill all bottles, fill metals and TKN (if applicable) bottles only half to three-quarters full. If NH_3, and total phosphorous analysis is not required, fill NO_2/NO_3 bottle only half full. If the volume is so limited that one or more analysis must be omitted, the priority of analysis is as follows: • Total metals • Dissolved metals • Dissolved organic carbon • TDS, TSS, Alkalinity, SO_4 (and for SS-01, SS-05, SS-06G, and SS-07 chloride) • TKN (if applicable) • NO_2/NO_3 11. Dry sample bottles, and immediately place appropriate label on appropriate bottle.
DECONTAMINATION	1. Decontaminate all preparation equipment before proceeding to the next sample. To decontaminate the peristaltic pump, use a squirt bottle filled with DI to clean the end of the intake tubing. Place the intake tubing into a container containing a dilute (0.5%) HNO_3 solution (5% HNO_3 and deionized water). Pump through the tubing (run water into sink during this step). 2. Wipe down the work area between sample sites and install new pump tubing. 3. Always store tubing in a clean dry area. 4. Change gloves between each ISCO sample.
PRESERVING SAMPLES	1. If using pre-preserved sample bottles, no additional preservation is necessary. 2. If using sample bottles that have not been pre-preserved, wait until the end of the sample preparation shift to preserve samples. While preparing samples, set samples requiring differing preservatives in separate spaces. Raw (no preservative) samples should be stored in the refrigerator or on ice if refrigeration is not available. Bottles prepared for total and dissolved metals analysis should be set in a designated area. Bottles prepared for NO_2/NO_3, DOC, TKN, NH_3, and total phosphorous analysis should be set in an area separate from those prepared for metals analysis. Preserve all bottles prepared for metals analysis, then preserve all bottles prepared for nutrient analysis, or vice versa.
SAMPLE STORAGE	1. Refrigerate or cool all samples until laboratory delivery.
DOCUMENTATION	**1. Transformer Steps** Follow **Butte – StW Processing Steps: I Transformer Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20Processing%20Steps.aspx. **2. Download doForms** Download "Butte – StW Smple Clctn r0" doForms by following **DoForms Online Download Steps** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/DoForms%20Online%20Download%20Steps.aspx. **3. Prep/COC Steps** Follow **Butte – StW Processing Steps: II Prep/COC Steps** located at

	https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20Processing%20Steps.aspx. **4. Labels:** Use the appropriate pre-labeled ID or write in the ID associated with the sample. Add a dash and the date stamp recorded by the ISCO (-mmddyy) to the ID. Put the date of sample on the "date" line. Put the time of the first bottle of the sample on the "time" line. Provide the initials of the samplers on the "sampled by" line. **5. File Organization** Ensure that all documentation is complete and orgnanized appropriately by following **Butte – StW File Organization Details** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20File%20Organization%20Details.aspx
SHIPPING	1. Make sure the number of containers is correct to the number of sample bottles. Check to make sure that the sample ID and date stamp, date, and time match the COC. Ensure that there are initials of the preppers on the "sampled by" line and that the appropriate label (analysis) is on the correct bottle. Also, confirm that all lids are sealed properly. 2. Make any necessary changes to labels or the COC before packing. When the COC is correct, the person who is in the "Sampler's Name" box should sign under "Relinquished By / Affiliation" column on each page of the COC. Copy the COC to be filed with the shipping label receipt in the monthly file. Place the original COC in a zip lock bag and place it on top of the ice in one of the coolers to be shipped. 3. Special packing instructions for specific bottles: • Duct tape all raw bottle lids to the bottle. The lids on these bottles do not seal well, and often spill during shipment. • All amber glass bottles must be wrapped in bubble wrap and placed in a cooler of their own. Line the bottom of the cooler with a bubble sheet, and then top the bubble-wrapped bottles with another bubble sheet before closing and securing the cooler. 4. Fill all coolers as full as you can without squeezing bottles in too tight. If on the last coolers there are not enough bottles to completely fill the space, use any kind of appropriate filler to prevent bottles from falling over or sliding during shipment. 5. Place ice bags in a zip-lock bag and place two (winter) or three (summer) bags of ice on top of the bottles. Close the lid tight and duct tape around the seal of the cooler twice. Place an address label on the top of the cooler and a custody seal over the front latch of the cooler so it is visible when received at the lab. Attach the shipping label (after completing step 6 and 7) to the top of the cooler. Using "packing tape" (not duct tape), tape around the entire cooler (from the top to the bottom and back up to the top) to secure the shipping label and custody seal. Then proceed to tape over the top of the duct tape seal twice, again with packing tape. 6. Shipping Label: • In the From section: fill out the Date, Sender's Name, Phone, Company (TREC, Inc.), Address (1015 S. Montana St., Ste. C), City (Butte), State (MT), and Zip (59701). • In the To section: fill out Recipient's Name (Sample Receiving), Phone (612-607-1700), Company (Pace Analytical), Address (1700 Elm St. SE), City (Minneapolis), State (MN), and Zip (55414-2485). • In Express Package Service, check FedEx Standard Overnight when shipping Monday through Thursday, or "FedEx Priority Overnight" if shipping on a Friday. • In Special Handling and Delivery Signature Options, check SATURDAY Delivery if shipping on a Friday only. Check No under Does this shipment contain dangerous goods? • In Payment, check Recipient and fill in the FedEx Acct. No. as 9860-0221-9. Fill in the number of coolers being sent under Total Packages. Each coolers weight is approximately 65 pounds. 65 * total number of coolers is entered in Total Weight. 7. Make enough copies of the shipping label to go on each cooler. Stick the sleeve onto the top of the cooler before cooler is taped top to bottom with packing tape. 8. TDS and TSS analysis have short hold times of seven days. Email Shawn Davis Shawn.Davis@pacelabs.com or contact him at Pace (612-607-6378) to notify him that short-hold samples are being shipped. Be prepared to tell him the earliest sample collection time. 9. Either call for a pickup from FedEx or deliver the coolers to FedEx during their business hours. Make sure to take the Sender's Copy of the shipping label and secure it to the copy of the COC before filing.

SOP – SW – 13

CHANGE ISCO BATTERIES on SAMPLERS LOCATED IN MANHOLES

Authorized for use: 02/02/2018
Revision: 2

SCOPE	This SOP addresses changing 12-volt batteries on ISCO flow meters and samplers.
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-010: Remove Manhole Cover TRA1-013: Collect ISCO Sample Change Battery
STOP WORK TRIGGERS	Lightning (30 -30 rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Permits (working at heights or confined space) if conditions dictate it is necessary and forms not completed
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Clothing Shirt/Jacket/Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	12-volt ISCO battery Magnetic manhole lifter and/or manhole hook Traffic control equipment Manhole guard if necessary Plywood or another barrier to cover hole
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Janelle Garza Daniel Cas Caleb Arbaugh Michael Picker
PROCEDURES	
IMPLEMENT JOB ZONE/TRAFFIC CONTROL	1. Refer to Job Zone/Traffic Control Plan and use appropriate traffic control for each site (if applicable).
POSITION VEHICLE	1. Position rear of vehicle near manhole by pulling vehicle an appropriate distance from the manhole, using a spotter or side mirror of vehicle.
REMOVE MANHOLE COVER	1. Refer to SOP-G-01_RemoveReplaceManholeCover and replace manhole cover.
REMOVE ISCO SAMPLER FROM MANHOLE	1. Install hoist in the back of TREC 17 using the proper bracket installed in the bed of the truck. Inspect the hoist and/or tri-pod using the appropriate DoForm. Project: Butte-HSSE Form: Butte HSSE – StW Eq Insp. Wearing work gloves swing the hoist out so that it is situated directly above the center of the sampler manhole bracket. If the hoist cannot be used set up the tripod over the manhole before removing the manhole lid. Attach the hook on the hoist to the lift handle of the bracket that the sampler is suspended from. Slowly retract the hoist cable. It may be necessary to have another employee guide the sampler as you are removing it from the hole. When the bottom of the sampler is elevated slightly above street level, place a piece of plywood or another barrier over the manhole opening. Set the sampler down on top

	of the plywood barrier. Leave the plywood in place while working on the sampler. Lower the hoist/tripod slightly to release tension on the sampler suspension cables. Remove the sampler suspension cables from the brackets on the sampler and slowly swing the hoist, attached to the bracket, to a location so the hoist will not swing freely while working on sampler.
CHANGE ISCO SAMPLER BATTERY	1. Still wearing leather gloves, unhook the three closures that secure the lid to the sampler and remove the lid. 2. Remove the battery from the sampler by unhooking the two tabs on either end of the battery and unscrewing the battery connection. 3. Place the new battery on the sampler, secure the tabs and screw the connection into the proper port. 4. Check the date and time on the sampler, confirm MST, make any necessary corrections and record in logbook. To make changes, first hit the STOP key. Press the ENTER PROGRAM key. Use the arrow key to choose Configure Sampler. At the Select Option (← →) Clock display, press the ENTER PROGRAM key. The display reads HH:MM DD MM YY. Make any necessary changes and proceed through the screen by pressing the ENTER PROGRAM key. Continue through the program until taken to the next screen. Press the EXIT PROGRAM key to return to the main display, which will read Program Halted. Press start sampling, and press ENTER until the display reads 'SAMPLER INHIBITED' 5. Ensure that the sampler is turned on and the display reads "Sampler Inhibited". 6. Replace the lid of the sampler, re-attach the lid closures.
REPLACE ISCO SAMPLER IN MANHOLE	1. Slowly move the hoist with the manhole bracket attached back to the manhole until it is suspended over the sampler. Re-attach all three sampler suspension cables. Slowly retract the hoist cable until the bottom of the sampler is elevated slightly above street level and remove the plywood barrier. **Only remove the plywood barrier when the sampler is in place and ready to be lowered into the manhole.** Slowly lower the sampler into the manhole, until the manhole bracket catches on the perimeter of the manhole. Again, another employee may be necessary to guide the sampler into the manhole. Ensure that the bracket is stable and lower the hoist to release the tension, disconnect the hoist hook from the bracket handle, and secure the hoist hook to the tie-down bracket in the vehicle to stabilize hoist movement between sites.
REPLACE MANHOLE LID	1. Refer to SOP-G-01_RemoveReplaceManholeCover SOP to replace cover.
MOBILIZE	1. Take down all job zone/traffic control equipment (if utilized). Pull away from the manhole in a forward direction, when mobilizing to next site.
DOCUMENTATION	1. Record all pertinent information in logbook. Date, time, site name, battery number removed, battery number installed, and if sampler inhibited upon departure.

SOP – SW – 14

COLLECT SAMPLE FROM ISCO SAMPLER in MANHOLE

Authorized for use: 02/06/2018
Revision 4

SCOPE	This SOP addresses collecting samples from automatic (ISCO) samplers and checking automatic samplers for proper operation.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards, Driving, Trailer, Load/Unload Equipment TRA1-010: Remove Manhole Cover TRA1-013: Collect ISCO Sample / Change Battery
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Permits (working at heights or confined space) if conditions dictate it is necessary and forms not completed
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Shirt/jacket/Vest Gloves (impervious, leather) Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Sampler bottles, brackets, and tubs Decontamination bottle Decontamination solution Manhole guard Magnetic manhole cover remover and/or manhole hook Traffic Control Equipment (Candles, Drums, Signs) Plywood or other barrier to cover hole Sampler base lifter
Trained, Competent and Authorized Employees in this SOP	Tina Donovan Alice Drew-Davies Janelle Garza Daniel Cass Caleb Arbaugh Michael Picker
PROCEDURES	
IMPLEMENT JOB ZONE/TRAFFIC CONTROL PLAN	1. Refer to Job Zone/Traffic Control Plan and use appropriate traffic control for each site (if applicable).
POSITION VEHICLE	1. Position rear of vehicle near manhole by pulling vehicle an appropriate distance from the manhole, using a spotter or side mirror of vehicle.
REMOVE MANHOLE COVER	1. Refer to SOP-G-01_RemoveReplaceManholeCover and remove manhole cover.
REMOVE ISCO SAMPLER FROM MANHOLE	1. Install hoist in the back of TREC 17 using the proper bracket installed in the bed of the truck. Inspect the hoist and/or tri-pod using the appropriate DoForm. Project: Butte-HSSE Form: Butte HSSE – StW Eq Insp. Wearing work gloves swing the hoist out so that it is situated directly above the center of the sampler manhole bracket. If the hoist cannot be used set up

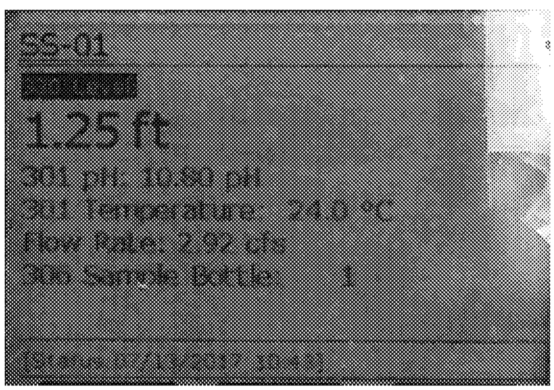
	the tripod over the manhole before removing the manhole lid. Attach the hook on the hoist to the lift handle of the bracket that the sampler is suspended from. Slowly retract the hoist cable. It may be necessary to have another employee guide the sampler as you are removing it from the hole. When the bottom of the sampler is elevated slightly above street level, place a piece of plywood or another barrier over the manhole opening. Set the sampler down on top of the plywood barrier. Leave the plywood in place while working on the sampler. Lower the hoist/tripod slightly to release tension on the sampler suspension cables. Remove the sampler suspension cables from the brackets on the sampler and slowly swing the hoist, attached to the bracket, to a location so the hoist will not swing freely while working on sampler.
COLLECT SAMPLE BOTTLES	1. Still wearing leather gloves, unhook the closures on the lid to the sampler. Remove lid. Inspect the sampler readout. If the readout is "Done", a complete set of samples will have collected. If the readout is "Sampler Inhibited", samples may or may not have collected. 2. To confirm if samples have collected, review sample collection on the readout. Press Display Status and choose Review. Use the right arrow key to move through the menu and choose Results. In the Results menu, continue to press Enter until Bottle 1 is reached. The sample collection date and time will display. Open the appropriate DoForm on the IPad. Record the sample dates and times in the form as you continue keying through to the end. Some samplers are programmed to collect 24 bottles (5 hour) and some are programmed to collect 18 (2.5 hour). Continue until all sample dates and times are entered. 3. Unhook the three metal closures on the lower portion of the sampler. 4. Lift the upper portion of the sampler off the lower portion, using the two handles. 5. Set the upper portion of the sampler onto a clean base. Put on nitrile or impervious gloves. Carefully cap and label each bottle in the base that collected. Be certain that the proper site name and ISCO sample number are recorded on the label and placed on the appropriate bottle. Each sample set contains three bottles, so it is necessary to mark three 1 Liter bottles as ISCO #1 with the correct collection date and site name.
REPLACE EMPTY SAMPLE BOTTLES AND RESET SAMPLER	1. After the bottles are capped, retrieve a sampler base of empty bottles from the truck bed. Be certain the frame is aligned properly within the tub. The tab on the frame should align with the number 3 on the outside of the tub. Be certain the upper portion of the bottle frame is secured to the lower portion with the three elastic cords. 2. Place the upper portion of the sampler back onto the lower portion and hook the closures. 3. Replace the battery on the sampler using SOP -SW-13 Change Isco Batteries on Samplers Located in Manholes. 4. On the actuator cord, flip the switch from toggle reset to latch and back again to toggle reset. 5. On the Sampler, press "Start Sampling" once, and quickly press "Enter Program" two times. The readout should display "Sampler Inhibited". 6. Replace the lid on the sampler and secure it with the three rubber fasteners.
LOWER SAMPLER INTO MANHOLE	1. Slowly move the hoist with the manhole bracket attached back to the manhole until it is suspended over the sampler. Re-attach all three sampler suspension cables. Slowly retract the hoist cable until the bottom of the sampler is elevated slightly above street level and remove the plywood barrier. **Only remove the plywood barrier when the sampler is in place and ready to be lowered into the manhole.** Slowly lower the sampler into the manhole, until the manhole bracket catches on the perimeter of the manhole. Again, another employee may be necessary to guide the sampler into the manhole. Ensure that the bracket is stable and lower the hoist to release the tension, disconnect the hoist hook from the bracket handle, and secure the hoist hook to the tie-down bracket in the vehicle to stabilize hoist movement between sites.
REPLACE MANHOLE LID	1. Refer to SOP-G-01_RemoveReplaceManholeCover SOP to replace cover.
MOBILIZE	1. Take down all job zone/traffic control equipment (if utilized). Pull away from the manhole in a forward direction, mobilizing to the next site.
DOCUMENTATION	1. Follow **Butte – StW I-Pad Steps –smpl** located at https://woodardcurran.sharepoint.com/sites/docs/DoForms/Butte%20-%20StW%20I-Pad%20Steps%20-smpl.aspx in order to record all field data on the tablet. 1. Label each sampled bottle with a lid label marked with the site name, the ISCO sample number (1-8) and the date of the storm.

SOP – SW – 20
Signature Bubbler Programming

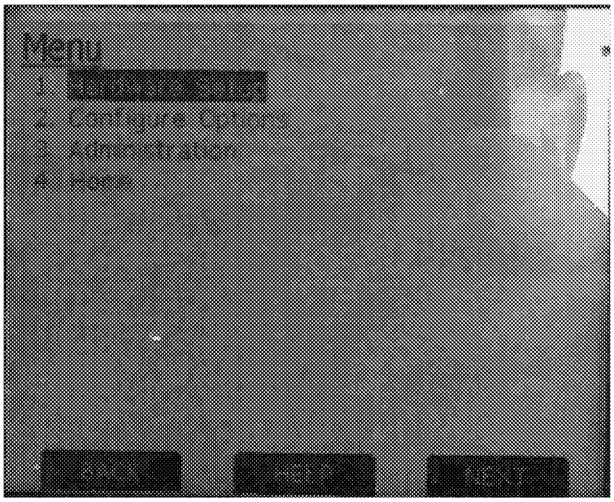
Authorized for use:
Revision 1

SCOPE	Programming and conducting necessary changes to the Signature Bubblers from ISCO currently at SS-01,06G, and 07
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment
MSDS	Arsenic Cadmium Copper Lead Mercury Zinc
PPE REQUIRED	Hard Hat Safety Toe Boots Safety Glasses High Visibility Shirt or Vest Gloves Long Sleeve Shirt Long Trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	USB Drive Micro USB to USB adaptor cable Bubbler Line and pH sensor attached
Trained, Competent and Authorized Employees in this SOP	Janelle Garza Jackie Dudding Michael Picker

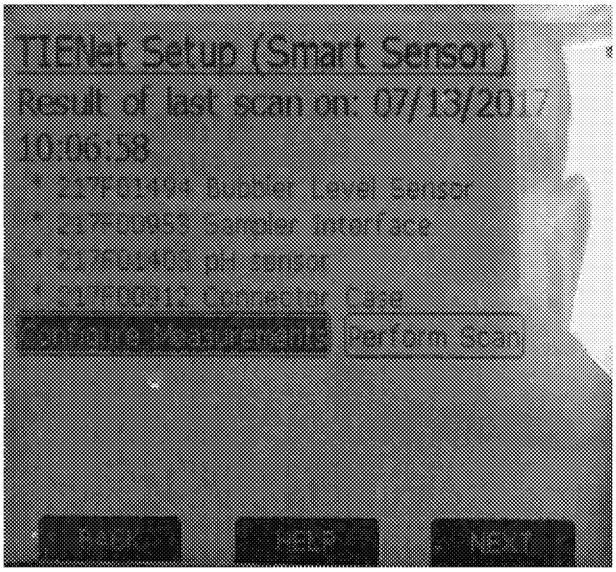
PROCEDURES

OPEN HOUSING BOX	1. Wearing work gloves, unlock the lock on the housing and remove the lock. Hanging it on the side of the box 2. Unlatch the stays, open the housing door, and store the lock on the shelf the Bubbler is on or hang on the side of the box.
SCANNING FOR ATTACHED TIENETS	1. Press any button to awaken the bubbler, the backlight will turn on and you will be at the main menu screen. 

2. Press the "B" button to get to the menu and select the "C" or next button when "Hardware Setup" is selected



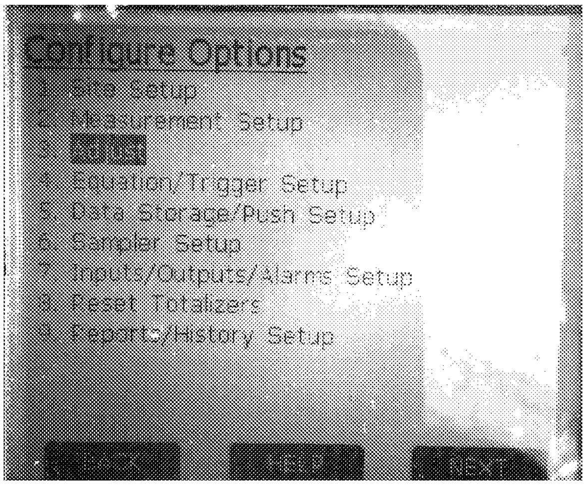
3. Once the Hardware Setup Menu has been opened select next when "TIENet Setup" (Smart Sensor) option is highlighted.
4. Scroll over to Perform Scan and click Next.
5. The Bubbler will display a message stating that it is loading.
6. Once it has finished loading it will display the screen below (this will depend on the amount of TIENets attached).



7. Once all attached TIENets have been identified then proceed to the programming steps.
8. Press the House icon on the 4 way track pad to return to the home screen.

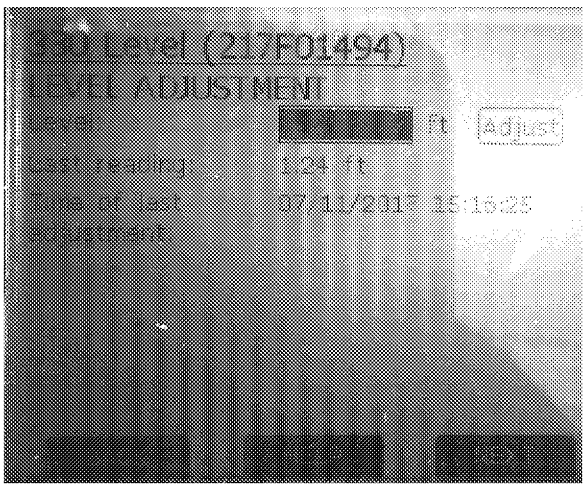
ADJUSTING THE STAGE

1. Obtain stage following the procedure outlined in SOP-SW-06-ReadSG
2. From the home screen press the “B” or “Menu” button and select “Configuration Options”
3. Once in the Configurations Menu select the “Adjust” option



4. Once “Adjust” has been selected then select the first option labeled “Level”

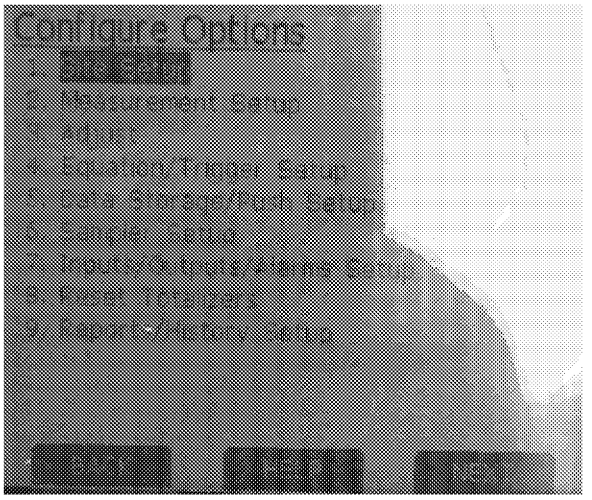
5. Select “Level” and the desired sampler then enter the desired stage into the space provided and hit “Adjust”



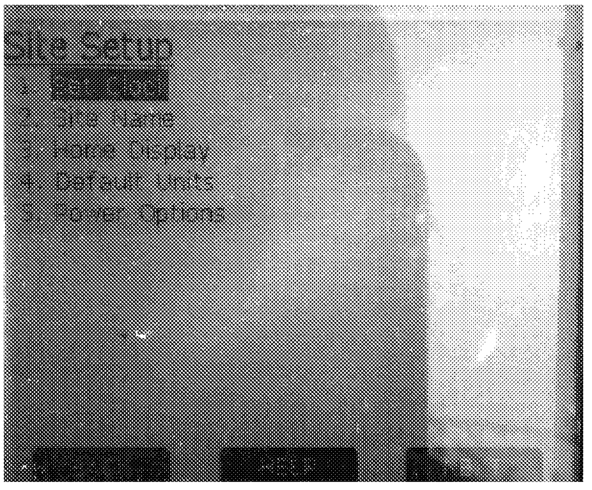
6. Wait until the last reading zone reads to within 0.01 of what was entered then press the “Home” button

SITE SET UP

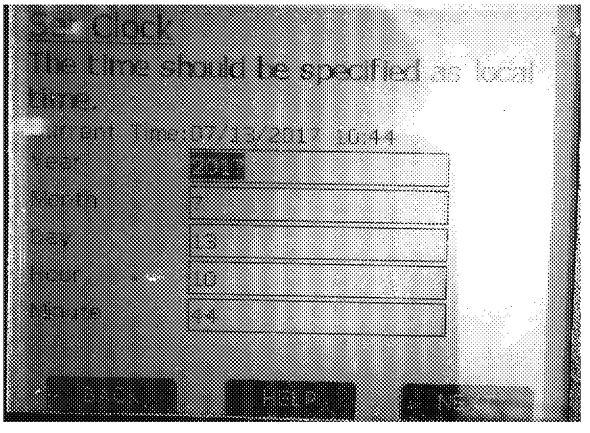
1. To set the site information and values begin at the home page.
2. See the previous section to get to the configuration menu and select "Site Setup"



3. Once site set up has been selected there will be multiple choices. From here the clock, site name, home display, default units and power options can be set.

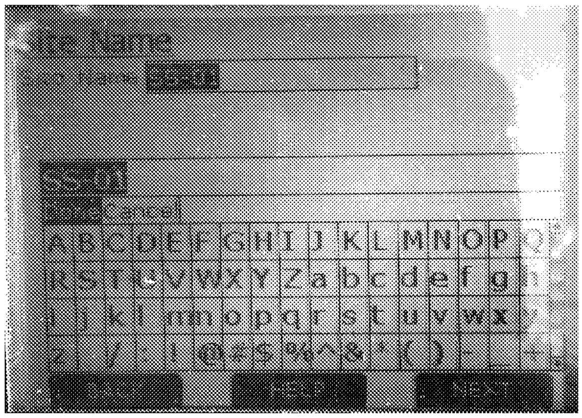


4. To set the clock select the "Set Clock" option

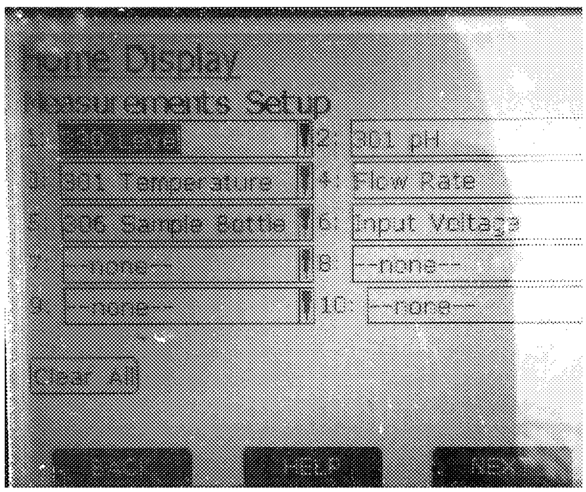


5. Once you have set the values for date and time to what is desired press the back button to get back to the site set up menu

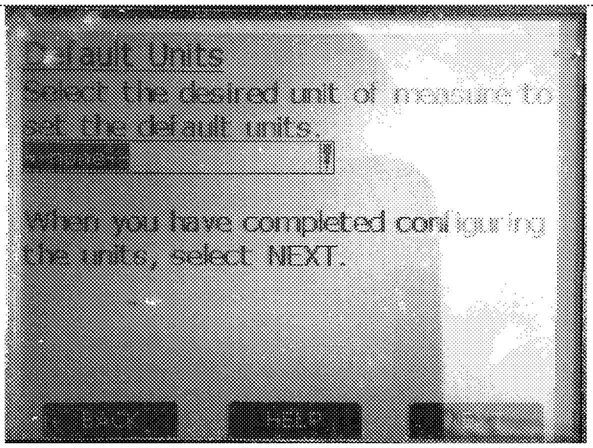
6. Once back in the Site Set Up menu select the Site Name option

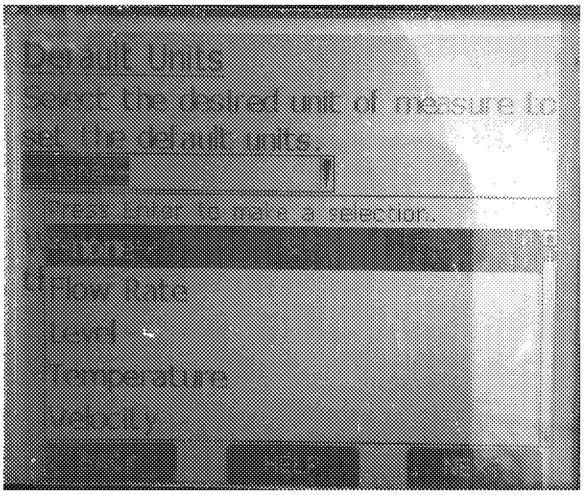


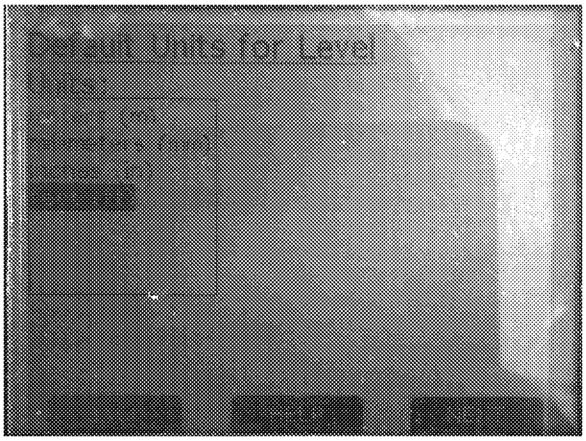
7. Use the keyboard to change the name of the site. Make sure to use the red x in the 4 way pad to backspace. NOTE: **you must click done when you are finished with the name otherwise it will not save the name.**
8. Once the name has been set then press the back button to return to the Site Set Up Menu
9. From the Set Up Menu select the third option "Home Display"
10. For each section select the drop down menu and then choose what you would like to be a part of the Home display.



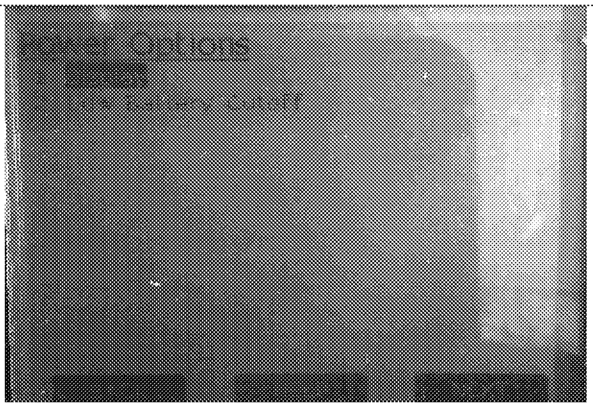
11. Once the different options have been chosen press the back button and return to the site setup menu.
12. From the Site Setup Menu select Default Units to set the units for different measurements
13. Use the drop down menu to select the measurement and indicate the units



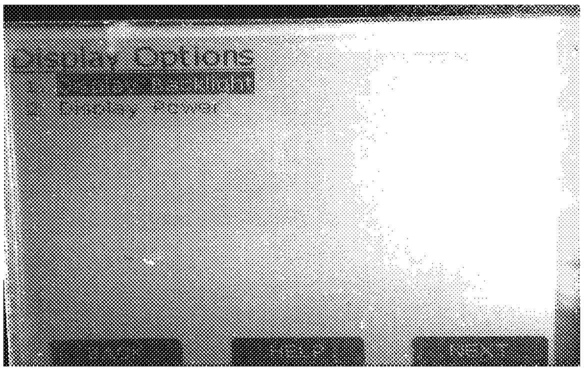




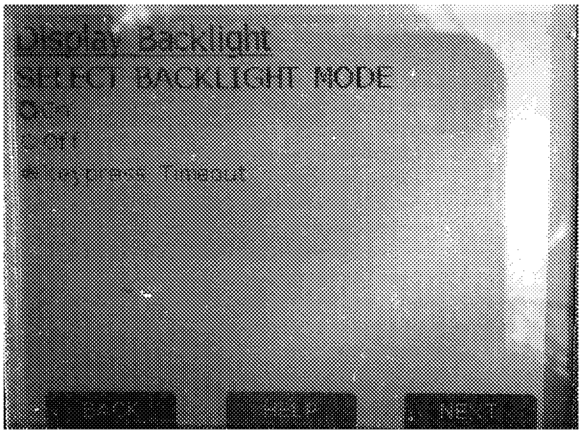
14. Once the units have been indicated press the back button to return to the Site setup Menu.
15. In the Site Setup Menu select Power Options



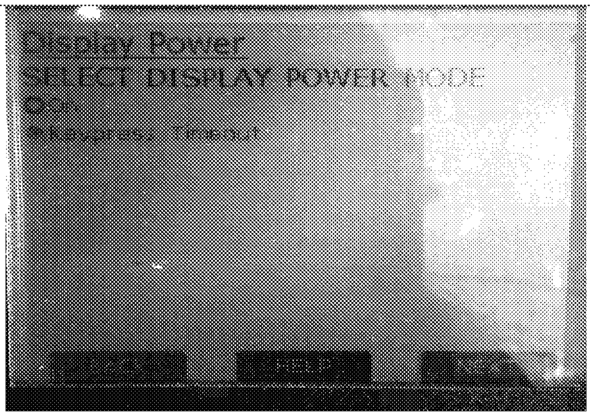
16. Selecting the display values opens up options for display customization



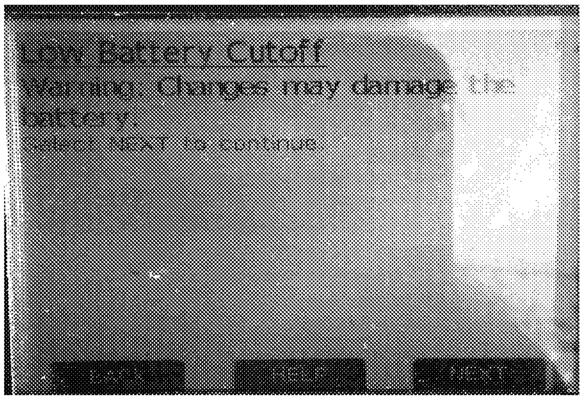
17. Select Display Backlight



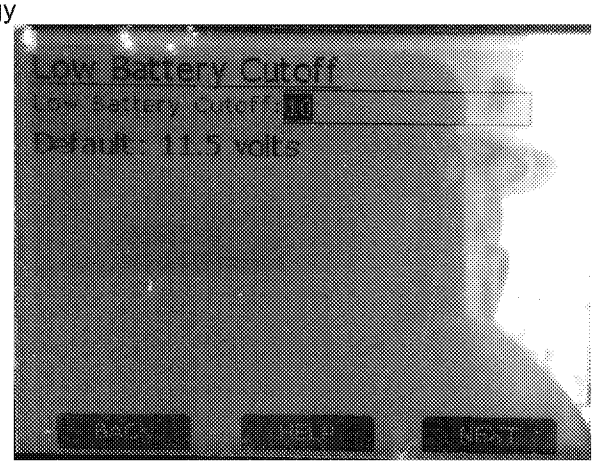
18. Alter the backlight options as needed then select the back button and select Display Power



19. Once Keypress Timeout has been selected press back to return to the Power Options Menu
20. Select the Low Battery Cutoff option



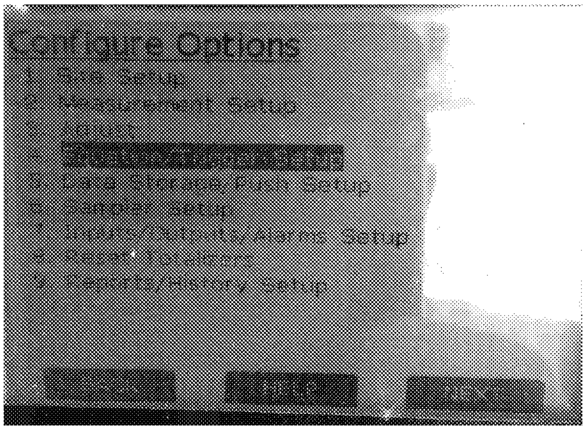
21. Click next when presented with a warning stating that changes may damage the battery
22. On the next screen enter the cut off voltage which will alert the machine to shut itself down to conserve energy



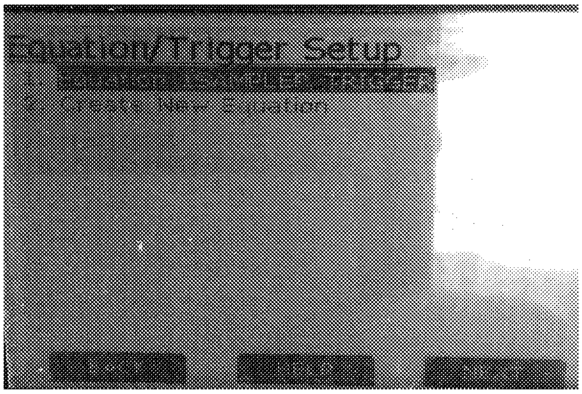
23. Once the value has been set click next to return to the power options menu
24. Press the home button to return to the main menu

Sampler Trigger and Settings Set Up

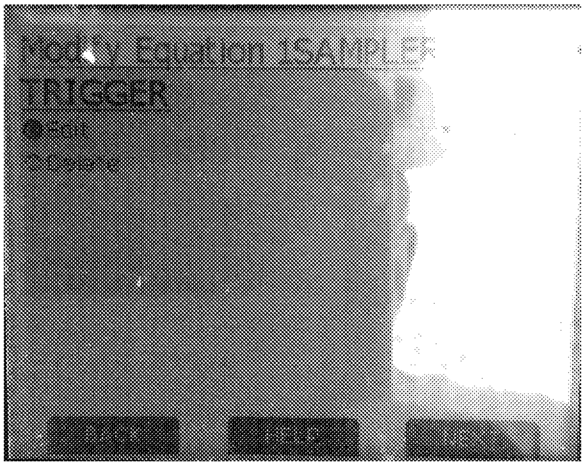
1. From the Home Screen press the menu button



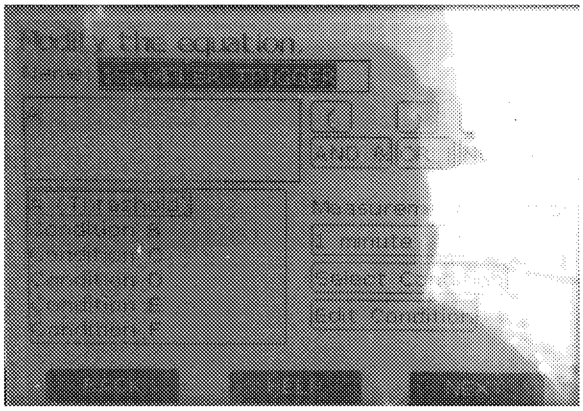
2. Select the "Equation/Trigger Setup" option



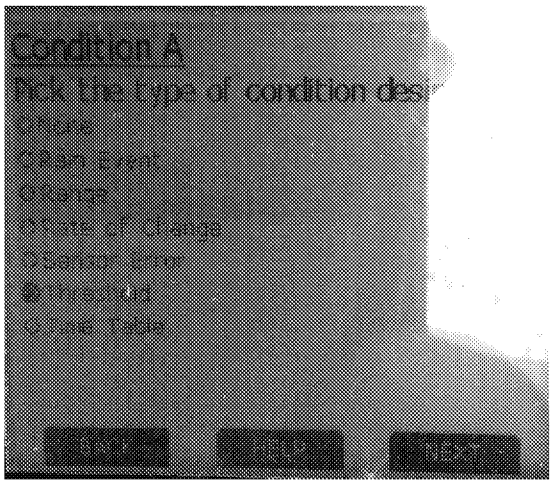
3. If multiple samplers then select the sampler you wish to set the parameter for
4. Select the Edit option in order to open the eqution/trigger setup page NOTE: **DO NOT SELECT DELETE AND CLICK NEXT. THIS WILL DELETE THE TRIGGER EQUATION**



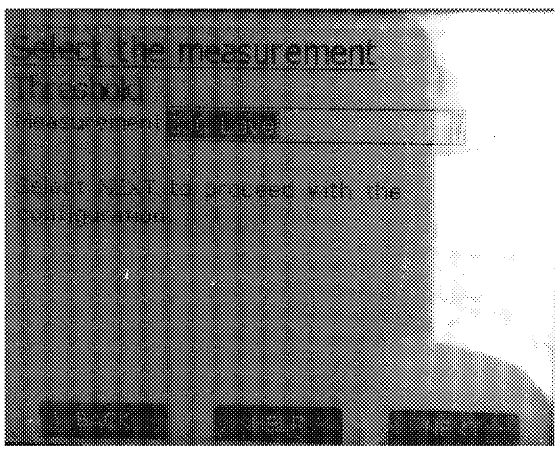
5. Once you click Next the "Modify the Equation" page will appear



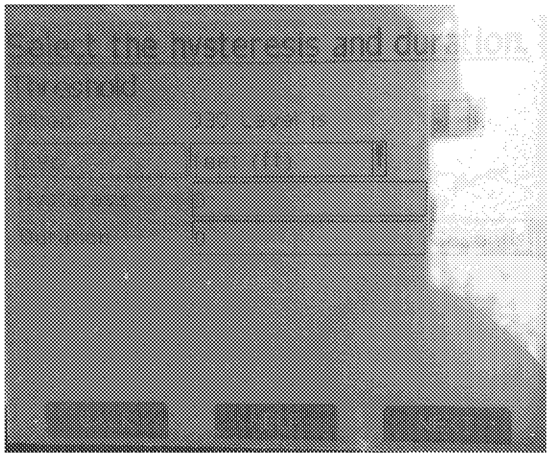
6. To edit the condition scroll down to the “Edit Condition” button **NOTE: MAKE SURE TO KEEP THE “A (THRESHOLD)” OPTION SELECTED. IF ANOTHER CONDITION IS SELECTED THEN THE EDITING WILL BE DONE FOR THAT CONDITION, NOT THE PERTINENT CONDITION**



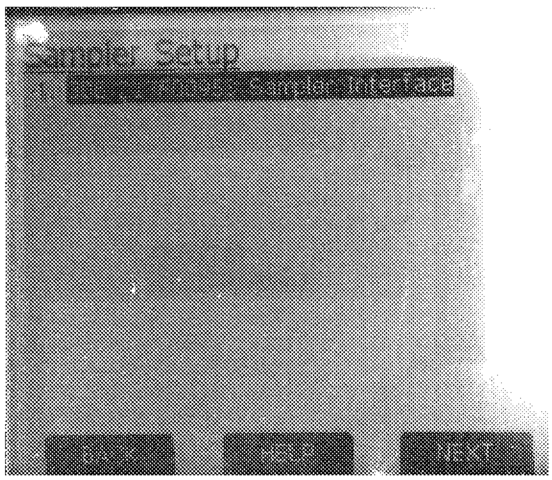
7. For “Condition A” select the “Threshold” option by moving the circle selector then pressing “Next”



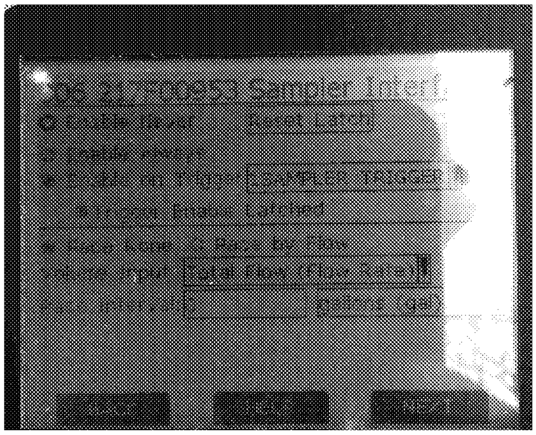
8. In the “Measurement” section select “330 Level” and press “Next”



9. On this screen you will set the condition required for the bubbler to trigger the sampler. You will designate the operator and function. For example: now the slide reads that when the 330 Level is greater than 1.96 feet the sampler will be triggered. You must specify whether the operator is greater than, less than or the equal to the trigger condition. Leave the Hysteresis and Duration values at 0. Click “Next” when you are finished.
10. Once you have clicked “Next” the Equation/Trigger Setup menu will appear again. Press the Home button to return to the homescreen
11. From the home screen select “Menu” option then select “Configure Options”
12. From here select “Sampler Setup”. A list containing all connected and recognized samplers will appear



13. Select the appropriate sampler from the list and click “Next”. Most bubblers will have only one sampler attached but be careful to select the appropriate sampler if there are multiple.
14. Once the correct sampler has been selected the Sampler Interface setup screen will appear.
15. Select “Enable on Trigger” and make sure to select the previously created trigger condition in the “Enable on Trigger” pull down menu.

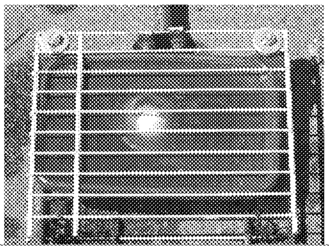
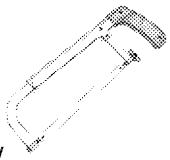
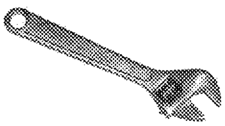
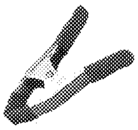
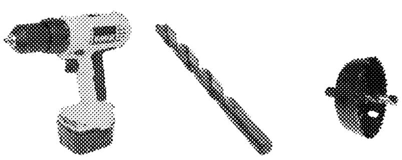
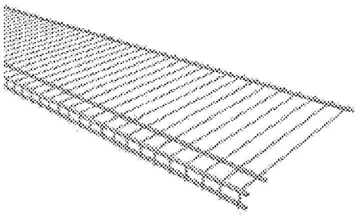


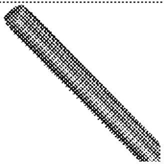
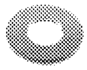
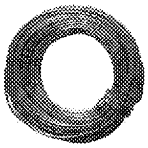
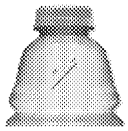
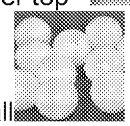
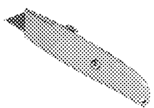
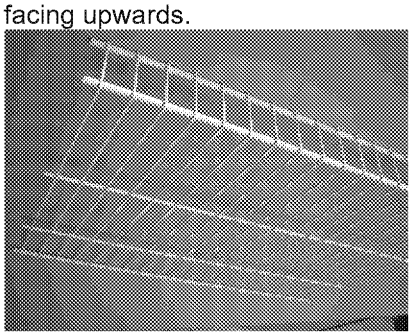
16. Select the "Trigger Enable Latched" checkbox **NOTE: THE "TRIGGER ENABLE LATCHED" CHECKBOX MUST BE UNCHECKED WHEN INHIBITING THE SAMPLER. WHEN INHIBITING THE SAMPLER:**
    a. **RETURN TO THIS MENU AND UNCHECK THE "TRIGGER ENABLE ON LATCHED" CHECKBOX AND CLICK NEXT**
    b. **INHIBIT THE SAMPLER AND VERIFY SAMPLER READS "*SAMPLER INHIBITED*"**
    c. **RETURN TO THE "SAMPLER SETUP" PAGE AND RECHECK THE "TRIGGER ENABLE LATCHED" CHECKBOX AND CLICK NEXT**
    d. **THE SAMPLER IS NOW INHIBITED AND READY FOR SAMPLING**
17. Select the option "Pace None" and click "Next". This will return you to the Sampler selection page.
18. Press the Home button to return to the Home Screen

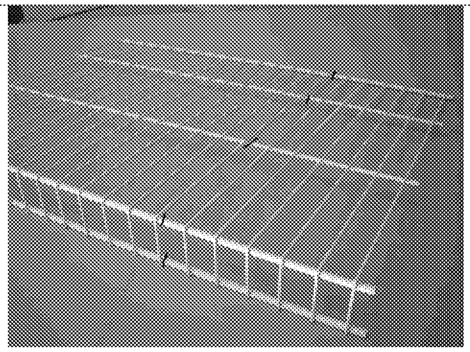
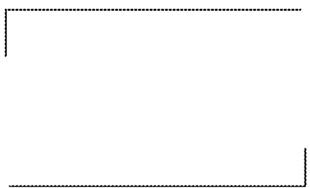
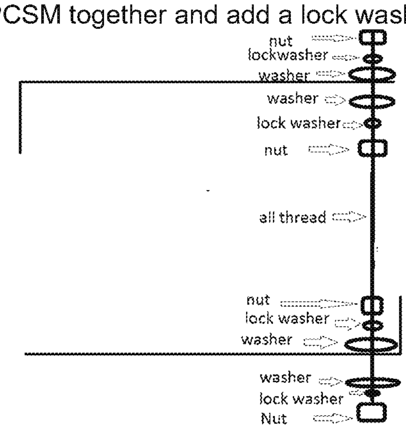
SOP-SW-017

Construction of TTEC sampler

Authorized for use: 07/06/2015
Revision 0

SCOPE	This SOP addresses the construction of the TTEC (low profile water collection device). 
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-018: Working with hand/power tools
STOP WORK TRIGGERS	Unsafe conditions Inadequate PPE or equipment
MSDS	
PPE REQUIRED	Safety Glasses Safety Toe Boots Work gloves Long Sleeve Shirt Hard Hat (if outdoors)
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS	Hacksaw  Crescent wrench  Clamps  Cordless drill, bits, and hole saw attachment  Plastic covered shelving material 

	___all thread (2)  ___sized nuts (8)  ___sized washers (8)  ___sized lock washer (8)  Wire  Plastic container  Drink container top  Ping pong ball  Razor knife 
Trained, Competent and Authorized Employees in this SOP	Dan Cass
PROCEDURES	
Creating the housing for the sampler	1. Pick an appropriate sized container for the projects need. 2. Place plastic covered shelving material (PCSM), such that the ninety degree angled lip is facing upwards.  3. Place the short edge of the container lid onto the PCSM, against the ninety degree angled lip, just inside of the edge of the PCSM. Measure two whole sections beyond the edge of the lid. Mark with sharpie pen on all supports, at the position to be cut.

	 4. Secure PCSM with clamps to a flat surface, and with a box or garbage can below to catch metal shavings. 5. Using proper PPE, cut through the PCSM at the locations marked with a hacksaw. 6. Repeat steps 1-4 to produce a matching piece of PCSM. 7. Measure overall height of both pieces of PCSM as well as container, add height of two nuts and two washers. Take overall height and cut two pieces of all thread to this measurement, utilizing the same flat workspace and clamps. 8. Place both pieces of the PCSM together in an L 7 position.  9. Take one piece of all thread, attach 1 nut, 1 lock washer, and 1 washer, and slide up from the bottom of your L 7 frame through the outer most gap. Place another washer to clamp the PCSM together and add a lock washer and nut. Repeat for the top.  10. Repeat process for the other side. 11. Take two generous amounts of wire, fold each in half, and wrap loose ends around the bottom of the PCSM cage you just created opposite of the all thread supports. Leave enough length for the looped ends remaining to be wrapped over the top of the PCSM cage in order to secure the container.
Preparing container for sample	1. With clamps, secure the lid of the container used to your sturdy flat surface. Cautiously take the hole saw and cut, in the center of the lid, a clean hole for the Ping-Pong ball to stop against. 2. Using a plastic drinking container (Gatorade bottle works well) clean and cut bottle to fit snuggly just inside of the container being used for water collection. Drill multiple holes in the side and bottom of the drinking container to allow for water and sediment to pass easily through. 3. Place Ping-Pong ball inside of plastic drinking container and place lid on sampling container. 4. Slide container into the PMCS cage and secure with wire tie downs.
Adding temperature measuring devices	1. In the case that temperature measuring devices are used in the TTEC sampler, take the temperature measuring device and trace the outline of the bottom onto the lid of the container.

	Carefully cut out the tracing with a razor knife with the container lid on a flat wooden surface, clamped down. 2. Place the temperature measuring device into the container through the lid and secure the top of the temperature measuring device with wire to the PCSM cage.

SOP – SW – 18
Calibrate TieNet 301 pH Sensor (Signature Bubbler)

Authorized for use: 121417 Revision 1	
SCOPE	This SOP addresses the manual calibration of TieNet 301 Sensor (connected to the ISCO Signature Bubbler.)
TRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards Driving Trailer Load/Unload TRA1-041: Equipment Claibration
STOP WORK TRIGGERS	Unsafe conditions Lightning Inadequate PPE or equipment Inability to access the work area safely Defective equipment Improper tools
MSDS	Buffer Solution pH 7.00 Buffer Solution pH 4.01 Buffer Solution pH 10.02
PPE REQUIRED	Safety-toed boots Safety glasses Gloves (nitrile, impervious) Long sleeve shirt Long trousers High vis shirt/vest
OTHER INSTRUCTIONS/SOPs	Refer to product manual for troubleshooting, maintenance, and further information.
REQUIRED TOOLS	Signature calibration kit: Buffer Solution pH 7.00 (rinse and buffer) Buffer Solution pH 4.01 (rinse and buffer) Buffer Solution pH 10.02 (rinse and buffer) Toothbrushes and/or Q-tips
Trained, Competent and Authorized Employees in this SOP	Alice Drew-Davies Janelle Garza Daniel Cass Michael Picker
PROCEDURES	
Perform a 3-pt pH calibration on YSI	1. See SOP-H-05, Calibrate YSI Pro-Plus Multi-Meter (3-point)
pH (SU)	1. Remove probe from plastic enclosure in creek. 2. Very carefully, clean probe with toothbrush and/or Q-tips and rinse after cleaning. 3. Starting with neutral (pH 7.00), place the probe in the rinse bottle and churn. Then place the probe in the buffer bottle to calibrate. Ensure that the probe is completely covered. 4. In lower temperatures, it may be necessary to allow a few minutes (up to 10 according to Teledyne ISCO tech. support rep.) for the temperature probe to adjust from the colder water temperature to the warmer buffer temperature. In such cases, watch the home screen to track stabilization of the temperature reading. Once temperature has steadied, calibration can commence. 5. Press Shortcuts (A) 6. Press (2) for "Calibrate pH" 7. Use the command numbers to highlight the desired calibration standard. Enter the pH buffer value from the original standard bottles (we use 7.00, 4.01, and 10.02) and Press "Next". 8. Allow the pH readings to stabilize; you need at least 2-3 readings <0.01 SU apart. 9. After stabilization, record final calibration value (also pay attention to 10. Repeat Steps 2-8 as necessary for pH 4.0 and 10.0 SU.
DOCUMENTATION	1. In the field book, record the arrival time and the site name. Record the task being performed and the calibration standard and temperature (ºC) observed on each point of the calibration. Also record the coressponsing parameters from YSI Pro Plus.
REPORTING	1. Update the last calibration date on the sign-in board and document in the spreadsheet for integrity management tracking.

APPENDIX C

Corrective Action Report

Corrective Action Report/
Corrective Action Plan

Project ID	Project Name	Document ID

Preparer's Signature/Submit Date	Submitted to:

Description of the requirement or specification	
Reason for the Corrective Action	
Location, affected sample, affected equipment, etc. requiring corrective action	
Suggested Corrective Action	(Continue on Back)
Corrective Action Plan	(Continue on Back) ☐ Approval signature/date:____________________ Approval of corrective actions required by EPA? ☐ Yes ☐ No ☐ EPA approval name/date:____________________ ☐ Corrective actions completed name/date:____________________
Preventative Action Plan	(Continue on Back) ☐ Preventative actions completed name/date:____________________

Corrective Action Report/ Corrective Action Plan

Suggested Corrective Action (Continued)	
Corrective Action Plan (Continued)	
Preventative Action Plan (Continued)	

Laboratory Management Program LaMP Chain of Custody Record

BP Site Node Path: BP > USA > MT > SILVER BOW > Butte Priority Soils > OM&M - Passive System > BPSOU Sampling & Monitoring

Req Due Date (mm/dd/yy): ____ **Rush TAT:** Yes ____ No ____

BP Facility No: Butte StormWater & BaseFlow

Lab Work Order Number: ____

Lab Name: Pace Analytical Services	Facility Address:	Consultant/Contractor: Environment West / Woodard & Curran
Lab Address 1700 Elm St SE, Minneapolis, MN 55414-2485	City, State, ZIP Code:	Consultant/Contractor Project No: 0231347.00-002-0001
Lab PM: Shawn Davis	Lead Regulatory Agency:	Address: 1800 W. Koch, Suite 6 Bozeman MT 59715
Lab Phone: 612-607-1700	California Global ID No.:	Consultant/Contractor PM: Scott Bradshaw
Lab Shipping Accnt: 9860-0221-9	Enfos Proposal No: D0150-0024	Phone: 406-586-8364 Email: sbradshaw@woodardcurran.com
Lab Bottle Order No:	Accounting Mode: 10 Provision X OOC-BU OOC-RM	Email EDD To: bpsoudata@woodardcurran.com and to lab.enfosdoc@bp.com
Other Info: WR322063	Stage: 3_Define (30) Activity: Interim Measures (123)	Invoice To: BP X Contractor ____

BP Project Manager (PM): Josh Bryson

BP PM Phone:

BP PM Email: josh.bryson@bp.com

Report Type & QC Level: Standard ____ Full Data Package ____

Lab No.	Sample Description	Date	Time	Matrix: Soil / Solid	Matrix: Water / Liquid	Matrix: Air / Vapor	Matrix: Is this location a well?	Total Number of Containers	Unpreserved	H2SO4	HNO3	HCl	Methanol		Al(T), As(T), Cd(T), Cu(T), Fe(T), Pb(T), Mo(T), Hg(T), Ag(T), Zn(T)	Al(D), As(D), Ca(D), Cd(D), Cu(D), Fe(D), Pb(D), Mg(D), Mo(D), Hg(D), Ag(D), Zn(D), Hardness	TDS, TSS, SO4, Alkalinity	Nitrate/Nitrite	Dissolved Organic Carbon	Total P, NH3 from NO2/NO3 bottle	TKN				Comments

	Relinquished By / Affiliation	Date	Time	Accepted By / Affiliation	Date	Time
Sampler's Name:						
Sampler's Company: Environment West / Woodard & Curran	EW/WC					
Shipment Method: Fed Ex Ship Date:						
Shipment Tracking No:						

Special Instructions: LL mercury analyses requested BPSOU SW Baseflow Monitoring

THIS LINE - LAB USE ONLY: Custody Seals In Place: Yes / No | Temp Blank: Yes / No | Cooler Temp on Receipt: ________°F/C | Trip Blank: Yes / No | MS/MSD Sample Submitted: Yes / No

Laboratory Management Program LaMP Chain of Custody Record

bp rm

BP Site Node Path: BP > USA > MT > SILVER BOW > Butte Priority Soils > OM&M - Passive System > BPSOU Sampling & Monitoring

Req Due Date (mm/dd/yy): ____ **Rush TAT:** Yes ____ No ____

BP Facility No: Butte StormWater & BaseFlow

Lab Work Order Number: ____

Lab Name: Pace Analytical Services	Facility Address:	Consultant/Contractor: Environment West / Woodard & Curran
Lab Address: 1700 Elm St SE, Minneapolis, MN 55414-2485	City, State, ZIP Code:	Consultant/Contractor Project No: 0231347.00-002-0004
Lab PM: Shawn Davis	Lead Regulatory Agency:	Address: 1800 W. Koch, Suite 6 Bozeman MT 59715
Lab Phone: 612-607-1700	California Global ID No.:	Consultant/Contractor PM: Scott Bradshaw
Lab Shipping Accnt: 9860-0221-9	Enfos Proposal No: D0150-0024	Phone: 406-586-8364 Email: sbradshaw@woodardcurran.com
Lab Bottle Order No:	Accounting Mode: 10 Provision X OOC-BU OOC-RM	Email EDD To: bpsoudata@woodardcurran.com and to lab.enfosdoc@bp.com
Other Info: WR322063	Stage: 3_Define (30) Activity: Interim Measures (123)	Invoice To: BP X Contractor ____

BP Project Manager (PM):	Josh Bryson
BP PM Phone:	
BP PM Email:	josh.bryson@bp.com

Report Type & QC Level: Standard ____ Full Data Package ____

Lab No.	Sample Description	Date	Time	Matrix: Soil / Solid	Matrix: Water / Liquid	Matrix: Air / Vapor	Matrix: Is this location a well?	No. Containers / Preservative: Total Number of Containers	Unpreserved	H2SO4	HNO3	HCl	Methanol		Requested Analyses: As(T), Cd(T), Cu(T), Fe(T), Hg(T), Pb(T), Zn(T)	As(D),Cd(D), Cu(D), Fe(D), Hg(D), Pb(D), Zn(D)	TSS, SO4								Comments

	Relinquished By / Affiliation	Date	Time	Accepted By / Affiliation	Date	Time
Sampler's Name:						
Sampler's Company: Environment West / Woodard & Curran	EW/WC					
Shipment Method: Fed Ex Ship Date:						
Shipment Tracking No:						

Special Instructions: Butte Hill Diagnostic StW SD - does not require low level mercury

THIS LINE - LAB USE ONLY: Custody Seals In Place: Yes / No | Temp Blank: Yes / No | Cooler Temp on Receipt: ________°F/C | Trip Blank: Yes / No | MS/MSD Sample Submitted: Yes / No

APPENDIX D

Data Validation Checklists

Exhibit 1 –Data Validation Checklist –Combined Field and Laboratory

Exhibit 2 - Level A/B Screening Checklist

Exhibit 3 – Data Flags, Qualifiers and Descriptors for DATA

Exhibit 4 – – Reference Document Citations

Exhibit 1 – Data Validation Checklist – Combined Field and Laboratory

ANALYTICAL DATA VALIDATION SUMMARY REPORT	
TREC Monitoring Project & Project Number:	**Monitoring Date:**
Lab & Lab Project Number:	**Lab Report Date:**
Validator & Affiliation:	**Validation Date:**
Validation Criteria: CFRSSI Data Management/Data Validation Plan and Addendum (ARCO 1992 and ARCO 2000, respectively); USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (USEPA, August 2017); Standard Operating Procedure for Validation of Inorganic Chemistry Data for CFRSSI 2016 (TREC, 2016)	
Approved Project QAPP:	
Analytical Methods and Parameters Evaluated	
General Chemistry Parameters:	
Metals, Dissolved by SW846 6020A: Metals, Dissolved by SW846 6020B: & Mercury, Dissolved by Metals, Dissolved by SW846 7470A	
Sample ID numbers	

BPS GW Sample Delivery Group (SDG)		
Field Sample ID #	**Laboratory Sample ID #**	**Natural Sample Matrix**
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water
		Water

LAB VALIDATION CRITERIA CHECK
Were Chain-of-Custody form(s) (COC) complete and accurate? Were samples received in proper condition and within a reasonable time frame for holding limits to be met?

Comments: ________ Yes ________ No ________
Were analytical methods and detection limits in compliance with project requirements? Were method specified or technical holding times met for sample prep and/or analysis? **Comments:** ________ Yes ________ No ________
Have *all* constituents requested for analysis, on the COC or under the QAPP, SAP, or other applicable document, been returned? Have *only* the constituents requested been returned? **Comments:** ________ Yes ________ No ________
Were reported units appropriate and consistent between sample and lab quality control data? **Comments:** ________ Yes ________ No ________
Were initial calibration verification (ICV) and continuing calibration (CCV) results within acceptance criteria? **Comments:** ________ Yes ________ No ________
Were initial calibration blank (ICB), continuing calibration blank (CCB), and method/preparation blanks (MB/PB) results non-detect? **Comments:** ________ Yes ________ No ________
Were there any detected results reported at the MDL value? **Comments:** ________ Yes ________ No ________
Were interference check sample (ICS) results within acceptance criteria? **Comments:** ________ Yes ________ No ________
Were laboratory control sample (LCS) results within acceptance criteria? **Comments:** ________ Yes ________ No ________
Were laboratory duplicate sample (LDS) results within acceptance criteria? **Comments:** ________ Yes ________ No ________
Were matrix spike (MS) and matrix spike duplicate (MSD) results within acceptance criteria? **Comments:** ________ Yes ________ No ________

Were MSD sample results within acceptance criteria? **Comments:** ______ Yes ______ No ______
Were surrogates evaluated in analyses for this SDG? If so, were recoveries within acceptance criteria? **Comments:** ______ Yes ______ No ______
Were serial dilution sample (SDS) results within acceptance criteria? **Comments:** ______ Yes ______ No ______
Were at least 10% of hard copy results compared to electronic data deliverable (EDD) results? **Comments:** ______ Yes ______ No ______
FIELD VALIDATION CRITERIA CHECK
Were an appropriate number of field blank (FB) and field duplicate (FD) samples collected to demonstrate field process accuracy and precision? **Comments:** ______ Yes ______ No ______
Were FB results non-detect? **Comments:** ______ Yes ______ No ______
Were natural-duplicate comparison results within matrix appropriate RPD criteria? **Comments:** ______ Yes ______ No ______
Were Level A/B criteria met for this sample delivery group (SDG)? **Comments:** ______ Yes ______ No ______
VALIDATION RESULTS SUMMARY

Exhibit 2 Level A/B Screening Checklist

I.	**General Information**	**II. Screening Results**
	Site/BIF: Project: Client: Sample Matrix:	Data are: 1) Unusable _______ 2) Level A 3) Level B
II.	**Level A Screening**	
		Yes/No
1.	Sampling date	
2.	Sample team/or leader	
3.	Physical description of sample location	
4.	Sample depth (soils)	
5.	Sample collection technique	
6.	Field preparation technique	
7.	Sample preservation technique	
8.	Sample shipping records	
III.	**Level B Screening**	
		Yes/No
1.	Field instrumentation methods and standardization complete	
2.	Sample container preparation	
3.	Collection of field replicates (1/20 minimum)	
4.	Proper and decontaminated sampling equipment	
5.	Field custody documentation	
6.	Shipping custody documentation	
7.	Traceable sample designation number	
8.	Field notebook(s), custody records in secure repository	
9.	Completed field forms (COC Record)	

Exhibit 3

DATA FLAGS, QUALIFIERS AND DESCRIPTORS FOR DATA

	Laboratory Flags[a]
U	Analyzed for, but not detected
J	Estimated concentration above the MDL and below the RL
B	Analyte was detected in the associated method blank
N	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits
*	RPD value was outside control limits
J+	Estimated concentration, serial dilution biased high
J-	Estimated concentration, serial dilution biased low
H	Sample analyzed past the holding time
H2	Sample received/analyzed past the holding time
E	Value above quantitation range
X	Value exceeds Maximum Contaminant Level (Drinking Water)
S	Spike recovery outside accepted recovery limits
S*	Spike recovery outside accepted laboratory recovery limits; within manufacturer limits
R*	RPD NA based on sample concentration
NA	Sample concentration is >4* spike level
R	RPD outside accepted recovery limits
	Data Validation Qualifiers[b]
CRQL -U	The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
	Data Validation Descriptors[c]
AB	Did not meet level A/B criteria
CC	Correlation coefficient less than 0.995 for instrument calibration
CCV	Continuing calibration verification outside limits
CCB	Continuing calibration blank contamination
CQ	No calibration performed
CRQL	Contract required quantitation limit standard recovery outside quality control limits
DNR	Do not report. An alternate, acceptable result is available.
ECR	Reported concentration exceeds instrument calibration range
FB	Field blank contamination
FD	Field duplicate RPD outside limits

HT	Holding time exceeded
ICB	Initial calibration blank contamination
ICS	Interference check standard recovery outside limits
ICV	Initial calibration verification outside limits
IP	Incorrect sample preservation
IS	Internal standard recovery outside limits
LCS	Lab control spike recovery is outside quality control limits
MB	Method blank contamination
MI	Matrix interference with analyte quantitation
MDL	Non-detect at MDL value
MS	Matrix spike recovery is outside quality control limits
RB	Equipment rinse blank contamination
RPD	Duplicate sample relative percent difference exceeds QC limits
SD	ICP serial dilution percent difference outside QC limits
SIC	Sample integrity compromised
SUR	Surrogate recovery is outside QC limits
TB	Trip blank contamination
TIC	Compound was tentatively identified by GC/MS search
	CFRSSI Status[d]
E	Enforcement quality data are data with unrestricted use, meet Level A/B criteria, and are NOT qualified during the data validation process
S	Screening quality data are data whose associated values are estimated or meet only Level A criteria
R	Unusable data are data whose associated numerical values are so questionable it is recommended that they not be used
	Source
[a] Assigned by MSE Analytical Laboratory	
[b] Adapted from US EPA 2010. Laboratory Data Validation National Functional Guidelines for Inorganic Data Review; EPA, January 2010)	
[c] Assigned by TREC, Inc. during data validation	
[d] Defined in Clark Fork River Superfund Site Investigations Data Management/Data Validation Plan; ARCO, May 1992)	

PART C – OVERALL DATA EVALUATION			
Data Validation Qualifier	**Level A / B Designation**		
	Level B	**Level A**	**Rejected**
None or U	Enforcement	Screening	Unusable
J or UJ	Screening	Screening	Unusable
R	Unusable	Unusable	Unusable

Exhibit 4

REFERENCE DOCUMENT CITATIONS

Atlantic Richfield, 2016. *Silver Bow Creek/Butte Area NPL Site, Final Quality Management Plan (QMP).* Atlantic Richfield Company May, 2016.

Atlantic Richfield, 2016. *Silver Bow Creek/Butte Area NPL Site, Final Ground Water Quality Assurance Project Plan (QAPP).* Atlantic Richfield Company, June, 2016.